AD NUMBER
AD815049
CLASSIFICATION CHANGES
TO: unclassified
FROM: confidential
LIMITATION CHANGES
TO: Approved for public release, distribution unlimited
FROM: Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; DEC 1958. Other requests shall be referred to Army CombatDevelopment Experimentation Center, Fort Belvoir, VA.
AUTHORITY
31 Dec 1970, DoDD 5200.10; USACDC ltr, 28 Dec 1971

[redacted]

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CONTROLLABILITY

of PENTANA-TYPE COMPANIES in MOBILE OPERATIONS

Sec 1473

VOLUME I

BASIC REPORT

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COMBAT DEVELOPMENT
EXPERIMENTATION CENTER
FORT ORD, CALIFORNIA

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Fort Ord, California

CONTROLLABILITY OF PENTANA-TYPE COMPANIES
IN MOBILE OPERATIONS
(CDOG-CDEC 58T6)

See 1473

PENTANA-TYPE ARTILLERY SUPPORT
(CDOG-CDEC 58T8)

DAVY CROCKETT SUB-EXPERIMENT
TO
CONTROLLABILITY OF PENTANA-TYPE COMPANIES
IN MOBILE OPERATIONS
(CDOG-CDEC 59T4)

FINAL EVALUATION REPORT

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CONTROLLABILITY OF PENTANA-TYPE COMPANIES IN MOBILE OPERATIONS

FINAL REPORT

VOLUME I: BASIC REPORT OF EXPERIMENT

VOLUME II: LOGISTICS

VOLUME III: ARTILLERY SUPPORT

VOLUME IV: DAVY CROCKETT

U.S. ARMY
COMBAT DEVELOPMENT
EXPERIMENTATION CENTER
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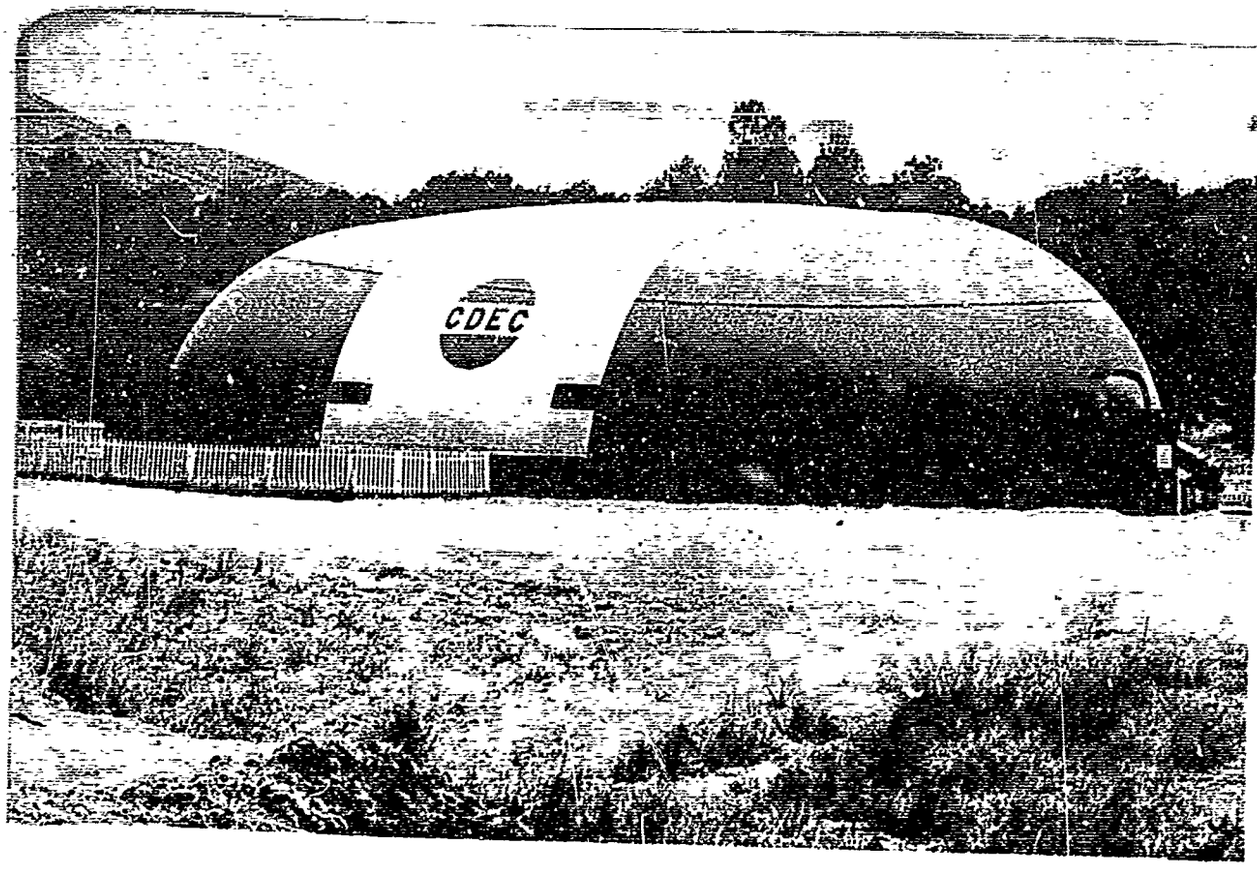

CDEC Experimental Operation Center ("The Bubble"), Hunter Liggett Military Reservation

ACKNOWLEDGEMENT

Experimentation at the US Army Combat Development Experimentation Center (USA CDEC) is conducted as a joint military-scientist team effort. Scientist and scientific support are provided by the Research Office staffed and operated by Technical Operations, Incorporated under Department of Army Contract Number ~~DA-04-351-AVI-1228~~, from 20 January 1958 until 30 June 1958 and by Stanford Research Institute thereafter under Department of Army Contract No. ~~DA-04-351-AVI-1465~~. now

VOLUME I

BASIC REPORT

OF EXPERIMENT

BASIC REPORT

PREFACE

The experiment that provides the basis of this report "Controllability of PENTANA-Type Companies in Mobile Operations" is one of a series conducted by the Combat Development Experimentation Center within the framework of an Integrated Combat Group (ICG). CDEC by experimenting with variations in organizations, weapons, tactics and techniques as applied in the various phases of warfare against known or possible potential enemy organizations has a mission of determining the best combination of firepower, tactics, logistical support, command and control, mobility, and combat surveillance recommendations for organizational and tactical concepts for United States Ground Forces.

Attention in this experiment was focussed on the command and control requirements of the PENTANA-type company and its capability to accomplish typical offensive and defensive missions over extended distances with nuclear and non-nuclear fire support. Specifically two types of headquarters and two command ranks were investigated. Concurrently the overall non-nuclear support requirements and the logistical support requirements of the PENTANA-Type Combat Group as generated by and extrapolated from the PENTANA-type company in these operations was investigated.

To determine the full range of possible impact of the employment of low yield nuclear weapons, the experimental forces and aggressor commanders were provided nuclear support and encouraged to use it when appropriate. The definition of appropriate targets and the assumption of unlimited stock of nuclear munitions occasioned their extensive use. Obviously the requirements for non-nuclear organic and supporting fires in this experiment vary greatly from what might be expected under circumstances where nuclear weapons were not available or available in limited quantities. In addition, both Experimental Forces and the Aggressor were mechanized and the protective characteristics attributed to their simulated carriers were such that the requirement for direct and indirect, nuclear and non-nuclear fires varied markedly from the requirements that might have been generated under circumstances involving greater exposure of the participating personnel. The discussions, conclusions and recommendations of the following report must be viewed in light of these environmental limitations.

To effectively account for unavoidable but undesirable variables such as capability differences between existing tactical organizations, differences in leadership capabilities and background of their

commanders, and differences in learning capability of the experimental and aggressor forces as a whole, an experimental design involving no less than four experimental companies was desirable. However, in meeting the overall requirements for experimental forces, aggressor forces, controllers, umpires and evaluators, the personnel available for the support of CDEC activities at the time of this experiment permitted the employment of only two different experimental companies. This compromise of basic design increased the difficulties normally inherent to statistical analysis of data and observations relating to performance characteristics. Specifically, greater observed and recorded performance differences were required to produce statistically significant results than could generally be attributed to differences in the candidates investigated. Furthermore many of the objectives were not, in the face of time and personnel limitations, capable of solution on the basis of scientific analysis of competing candidates. Capability of accomplishing defensive and offensive missions as well as tactical and logistical support requirements were objective areas in this category.

In appreciation of these unavoidable design shortcomings, the experiment was conducted in a manner to provide concurrent military observation and evaluation of all events bearing on the experimental objectives. As a result, while considerable difficulty was encountered in the analysis of data and observations to arrive at definite answers to some of the objectives, it will be apparent in the discussions contained in the report that a maximum of useful data was generated compatible with the limitations imposed on CDEC. Where definitive answers are not available, indications or trends significant thereto or indicative of appropriate areas of further investigation have been isolated. Furthermore, definitive conclusions and trends have been developed in areas germain to the PENTANA organizational and operational concept not specifically prescribed in the objectives of the experiment.

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ABSTRACT

1. (OFLUSE) General:

The Controllability of PENTANA-Type Companies in Mobile Operations and PENTANA-Type Artillery Support Experimentation was conducted at the Hunter Liggett Military Reservation from 20 May to 18 July 1958.

2. (OFLUSE) Purpose:

The purpose of the experiment was to determine capabilities of the PENTANA-type rifle companies in day and night operations, the effect of type of company headquarters on these capabilities, requirements for artillery support and logistical support requirements.

3. (OFLUSE) Description:

Two PENTANA-type rifle companies were compared in opposition to a mechanized aggressor task force supported by indirect nuclear and non-nuclear fires. Two type company headquarters were employed including an organic PENTANA company headquarters (Hq 1) and an augmented PENTANA company headquarters (Hq 2). Span of unit control and operational controllability were tested on frontages ranging from 2500-12000 yards. The PENTANA-type artillery support experiment and a DAVY CROCKETT sub-experiment were conducted concurrently and in conjunction with the Controllability Experiment. The evaluation reports on Artillery Support and DAVY CROCKETT are contained in Volumes III and IV respectively.

4. (OFLUSE) Evaluation:

a. Scientific members of the project team furnished an experimental design which provided for an unbiased comparison of three major variables -- span augmentation, command rank and headquarters structure -- and which would indicate, within the limitations of the mathematical model, significant differences if they existed. The design provided for evaluation of data and observations relating to performance capabilities and limitations. It also prescribed the precise order of events and the appropriate commander-headquarters combination for each record course.

b. Military evaluator-controller units were developed and trained to insure effective experimental control and accurate data collection. A comprehensive list of military and scientific indicators was prepared to insure the analysis of all pertinent data required for fulfillment of the stated purposes of the experiment.

c. Certain conclusions, based on both military evaluation and scientific analysis of data, have ensued. These conclusions must be viewed within the framework of the tactical environment utilized, i.e., completely mechanized forces, relatively unlimited availability of low yield tactical nuclear weapons, unavailability of observation aircraft or tactical air support to experimental or aggressor force, absence of enemy electronic countermeasures and constant aggressor strength and capabilities.

5. (C-MHA) Conclusions and Recommendations:

Controllability of PENTANA-Type Companies in Mobile Operations

a. Objective 1a:

To determine the capability of the rifle company operating as part of a combat group to accomplish the following mission over extended distances: Daylight offensive mission, using reconnaissance in force tactics and nuclear and non-nuclear weapons.

Conclusion:

The PENTANA Company, as organized for the Controllability Experiment, was capable of accomplishing daylight offensive missions as shown below:

(1) 2500-3500 yard span of operations: Seven of eight missions accomplished, with an average vehicular casualty rate of 48% over an average mission accomplishment time of nearly 3½ hours.

(2) 3500-8000 yard span of operations: Four of eight missions accomplished, with an average vehicular casualty rate of 38% over an average mission accomplishment time of nearly 2½ hours.

(3) 8000-12,000 yard span of operations: Two of eight missions accomplished, with an average vehicular casualty rate of 62% over an average mission accomplishment time of nearly 2½ hours.

Recommendations:

There are no specific recommendations for this objective; however, for recommendations relative to increasing PENTAMA Company capabilities to accomplish tactical missions, see Section XIII, Supplementary Conclusions.

b. Objective 1b:

To determine the capability of the rifle company operating as part of a combat group to accomplish the following mission over extended distances: Daylight defensive mission, using counter-reconnaissance tactics and nuclear and non-nuclear weapons.

Conclusion:

The PENTAMA Company, as organized for the Controllability Experiment, was capable of accomplishing daylight defensive missions as shown below:

(1) 2500-3500 yard span of operations: Two of eight missions accomplished, with an average vehicular casualty rate of 40% over an average mission accomplishment time of nearly 2 hours.

(2) 3500-8000 yard span of operations: Six of eight missions accomplished, with an average vehicular casualty rate of 31% over an average mission accomplishment time of nearly 2½ hours.

(3) 8000-12,000 yard span of operations: Six of eight missions accomplished, with an average vehicular

casualty rate of 20% over an average mission accomplishment time of nearly 1½ hours.

Recommendations:

There are no specific recommendations for this objective; however, for recommendations relative to increasing PENTAMA Company capabilities to accomplish tactical missions, see Section XIII, Supplementary Conclusions.

c. Objective 1c:

To determine the capability of the rifle company operating as part of a combat group to accomplish the following mission over extended distances: Night offensive mission, using nonnuclear weapons.

Conclusion:

It was not possible to adequately examine this objective and reach conclusions since control and umpiring techniques and procedures for night operations have not yet been perfected to the point that accurate casualty assessment, realistic play of indirect fires, or realistic interplay of direct fire elements is possible. However, it was determined that the employment of infrared devices promises increases in fighting potential during night operations on a frontage of 3500-8000 yards by permitting vehicular movement to objective areas with accuracy and secrecy approaching that of dismounted actions.

Recommendations:

(1) That continuing emphasis be accorded the development and standardization of simple power sources and viewing devices in the near infrared field.

(2) That increased emphasis be placed on the use of near infrared power sources and viewing devices in the training of United States Army ground forces.

d. Objective 2:

To determine the effect of several types of rifle company headquarters on the capability of the company to accomplish the missions set forth under Objectives 1a, b and c, above.

Conclusion:

The results of this experiment do not provide a large and consistent difference in performance on which to base an augmentation of the current company headquarters structure by the addition of reconnaissance and operations personnel. However, the limited time permitted for experimentation and competing requirements of other objectives did not permit an exhaustive examination of the candidates.

e. Objective 3:

To determine the effect on the capability of several types of rifle company headquarters to command and control the company in light of attachment of tanks, antitank guided missiles, close support artillery and an additional rifle platoon, and the availability of helicopters for lift of combat elements.

Conclusion:

There was no significant effect on the capability of the several types of rifle company headquarters to command and control the company in light of attachment of ground elements or the availability of helicopters for lift of combat elements.

Recommendation:

That in the study, development, and experimentation with proposed platoon and company level elements the traditional limitation of five subordinate elements be discarded in favor of an increase to between 6 to 10 to effect more economical utilization of control capabilities at this level.

f. Objective 4:

To determine the extent to which the several types of company headquarters can maintain continuous communications with subordinate elements when operating over extended distances.

Conclusion:

Both type rifle company headquarters, utilizing the communications equipment prescribed for the experiment (the VRQ series currently employed in armored infantry companies), had the capability of maintaining continuous radio communications with subordinate elements over distances up to 12000 yards. Radios were nearly 98% effective with only 59 recorded outages in 2928 radio situations (number of radios employed times number of

situations). The attachment of four additional subordinate elements to the rifle company had no apparent adverse effects on the communications capability of the company.

Recommendations:

That the VRQ series of all current radios be adopted as standard communications within company level elements of the combat arms.

g. Objective 5:

To obtain maximum factual data which will assist in the determination of the most appropriate rank for the company commander.

Conclusion:

On the basis of the data developed in this experiment, there was no evidence of significant differences in the performance capabilities of the captains and majors tested.

h. Objective 6:

To determine the logistical support requirements generated by the rifle company.

For discussion, conclusions and recommendations, see Volume II.

i. Objective 7:

To investigate techniques of aerial resupply and maintenance of the rifle company.

For discussion, conclusions and recommendations, see Volume II.

6. (U) Conclusions:

DAVY CROCKETT
Sub-Experiment

For statement of objectives, discussion, conclusions and recommendations, see Volume IV.

7. (C) Supplementary Conclusions:

a. (C) Within the framework of this experiment (complete mechanization of Experimental and Aggressor Forces and relatively unlimited availability of tactical nuclear munitions), the low-yield tactical nuclear weapons system emerged as the dominant and controlling influence on the battlefield as indicated by the following statistics:

	EXPERIMENTAL FORCE CASUALTIES	AGGRESSOR FORCE CASUALTIES
From Experimental Force Nuclear Weapons	13.0%	61.4%
From Aggressor Force Nuclear Weapons	37.0%	3.4%
Total Casualties from Nuclear Weapons	50.0%	64.8%

Recommendation:

That current tactical doctrine and training directives be appropriately revised to reflect the dominance of low-yield tactical nuclear weapons and the requirement for habitual dispersed tactics in training and field exercises and a necessity for armored protection of all elements in the forward combat areas.

b. (C) Experimentation developed indications of a point of diminishing returns with regard to number of tactical nuclear weapons employed at company level on a dispersed battlefield.

Recommendation:

That CONARC training directives contain guidelines relative the number of small-yield tactical nuclear weapons that may be made available for direct support of company level units in offensive and defensive operations during training and field exercises.

c. (C-NFA) On the tactical nuclear battlefield of the experiment, the direct fire tank-antitank weapons assumed increased importance, and the role of non-nuclear artillery, mortars, machine guns and rifles diminished sharply as evidenced by the following:

CAUSATIVE AGENT	EXPERIMENTAL FORCE CASUALTIES	AGGRESSOR FORCE CASUALTIES
Direct Fire (tank-antitank weapons)	49.0%	33.6%
Artillery	0.8%	1.6%
Mortars	0.1%	0.0%
Small Arms	0.1%	0.0%

Recommendations:

(1) That the antitank capability of the PENTANA-Type rifle company be substantially increased, either by providing all fighting vehicles of the company with a direct fire weapon capable of destroying any other armored vehicle, or increasing the numbers and improving the techniques of employment of antitank elements organic to and in support of the rifle company.

(2) That all artillery weapons of the PENTANA Combat Group be provided a dual capability, i.e., direct and indirect fire.

(3) That mortars be eliminated from the PENTANA Company and that responsibility for provision of indirect non-nuclear fire support be assigned the Combat Group Artillery Battery.

(4) That the number of crewmen in each rifle platoon fighting vehicle of the PENTANA rifle company be reduced to the minimum consistent with the mission to be accomplished.

d. (C-MHA) The Experimental Force had greatest success defensively and least success offensively as the dispersion increased as indicated by the following statistics:

SPAN OF OPERATIONS	DEFENSE		ATTACK	
	Succeed	Fail	Succeed	Fail
2500-3500 yard span	2	6	7	1
3500-8000 yard span	6	2	4	4
8000-12000 yard span	6	2	2	6

With respect to the experimental force, the ratio Aggressor/Experimental Force casualties was consistently unfavorable in offensive operations in all spans and increasingly favorable in defensive operations as the span of operations increased. This is evidenced by the following statistics:

SPAN OF OPERATIONS	RATIO AGGRESSOR CASUALTIES TO EXPERIMENTAL FORCE CASUALTIES	
	ATTACK	DEFENSE
2500-3500 yard span	.68	1.21
3500-8000 yard span	.90	1.40
8000-12000 yard span	.60	1.98

Recommendation:

That company level tactical doctrine, both present and future be revised:

(1) To emphasize dispersion on the tactical nuclear battlefield between platoons and between elements of the platoon to the maximum of line of sight observation, and

(2) To emphasize, within a framework of the strategic offensive, a concept of habitual adoption of a fluid tactical defensive posture to destroy an advancing enemy force, primarily through the application of nuclear firepower. As a corollary, to relegate the secondary consideration the traditional concept of tactical offensive action (to close with and destroy or capture the enemy by fire, maneuver and shock action), i.e., a course of action to be adopted only when the

situation precludes the exploitation of the fluid defensive posture.

e. (C-MHA) To exist on the tactical nuclear battlefield platoon and squad leaders must possess the maximum degree of skill, professional knowledge, initiative and determination.

f. (C-MHA) Development of accurate, instantaneous position location, transmission and display equipment for all elements on the tactical nuclear battlefield is mandatory.

Recommendation:

It is recommended that priority emphasis be accorded the research and development of accurate, instantaneous, position location, transmission and display equipment for all elements.

SECTION I

GENERAL INFORMATION

1. (OFLUSE) General:

This experiment was conducted at the Hunter Liggett Military Reservation from 6 May to 18 July 1958. This final report provides the results of the experimentation. Experimentation of the DAVY CROCKETT weapons system was superimposed on the parent experiment and is reported in Volume IV.

2. (U) Authority:

Letter, ATSWD-P 322/71 (CDEC)(14 Oct 57), Hq USCONARC, 14 Oct 1957, subject: "Directive for CDEC Experimentation Program".

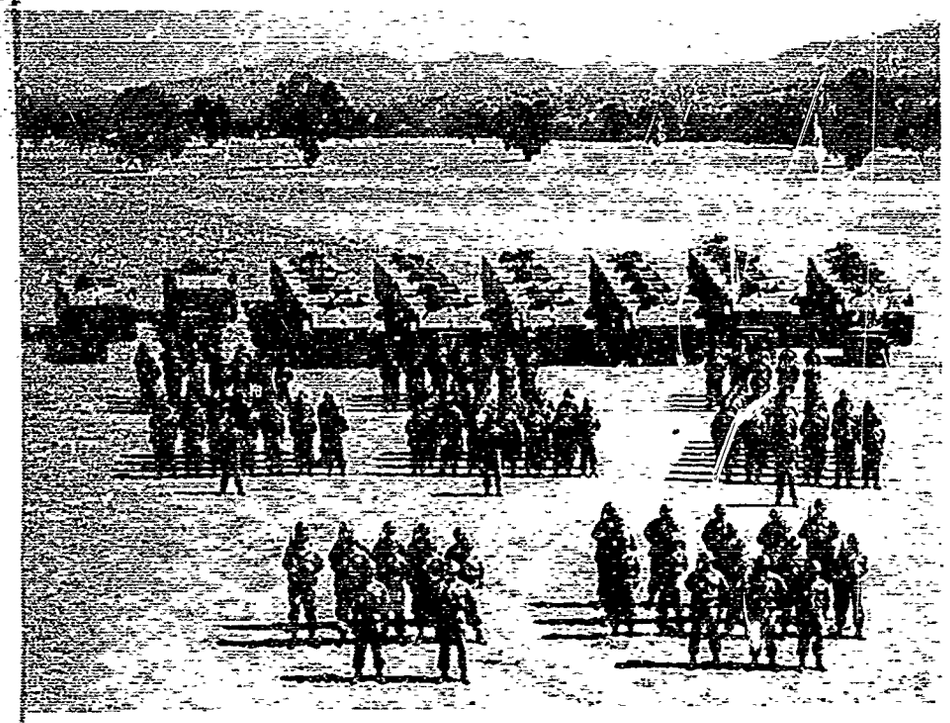
3. (OFLUSE) Purposes:

a. To determine the capability of the PENTANA-Type Rifle Company with varying numbers and types of subordinate elements to accomplish assigned missions in day and night operations over extended distances.

b. To determine the effect of two types of company headquarters on the capability of the company to accomplish these missions.

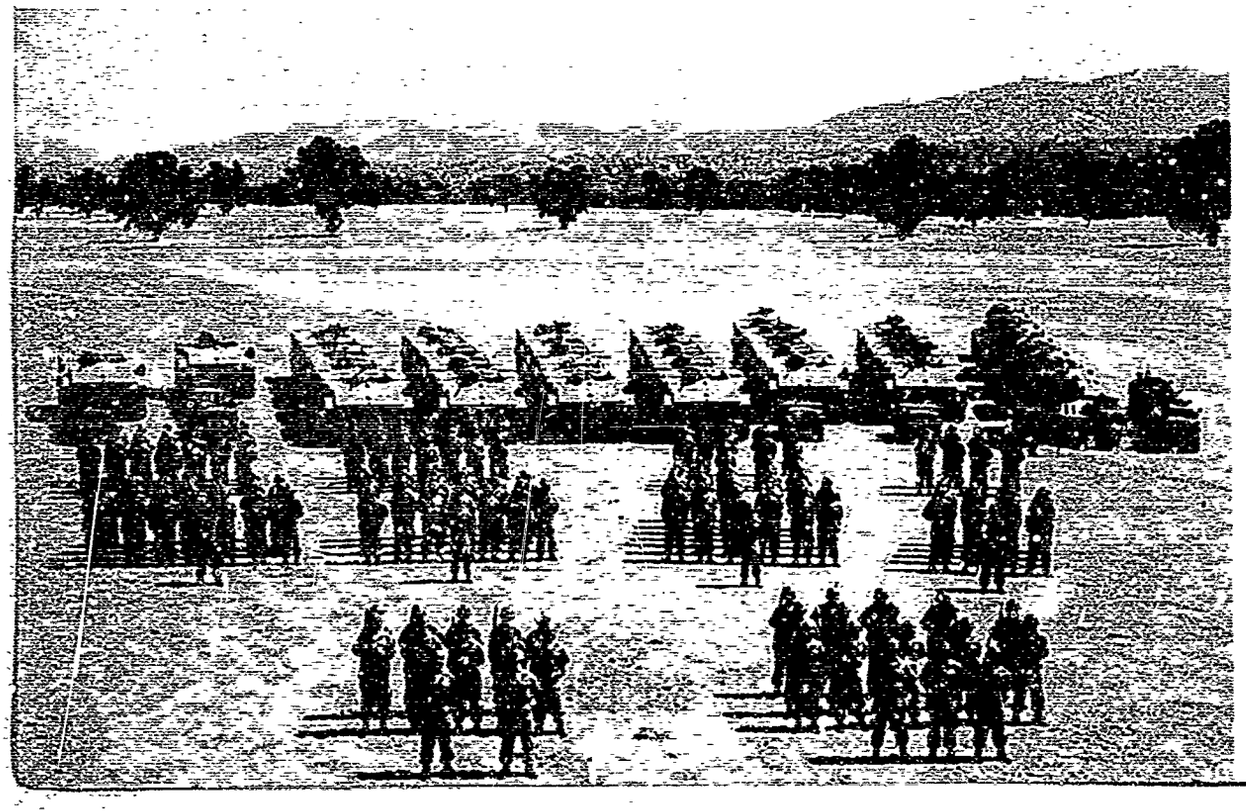
c. To determine the overall requirements of the PENTANA-Type Combat Group for continuous artillery support.

d. To determine the logistical support requirements generated by the PENTANA-type organization in the types of operation being examined.



Basic Experimental Company

Attachment of Tanks
and Guided Missiles



4. (C-MHA) Objectives:

a. The Controllability of PENTANA-Type Companies in Mobile Operations phase of the experimentation had as its objectives:

(1) Objective 1:

To determine the capability of the rifle company operating as part of a combat group to accomplish the following missions over extended distances:

(a) Daylight offensive mission, using reconnaissance in force tactics and non-nuclear and nuclear weapons.

(b) Daylight defensive mission, using counter-reconnaissance tactics and non-nuclear and nuclear weapons.

(c) Night offensive mission, using non-nuclear weapons.

(2) Objective 2:

To determine the effect of several types of rifle company headquarters on the capability of the company to accomplish the missions set forth under Objective 1 above.

(3) Objective 3:

To determine the effect on the capability of several types of rifle company headquarters to command and control the company in light of:

(a) Attachment of tanks.

(b) Attachment of antitank guided missiles.

(c) Attachment of close support artillery.

(d) Attachment of an additional rifle platoon.

(e) Availability of helicopters for lift of combat elements.

(4) Objective 4:

To determine the extent to which the several types of company headquarters can maintain continuous communications with subordinate elements when operating over extended distances.

(5) Objective 5:

To obtain maximum factual data which will assist in the determination of the most appropriate rank for the company commander.

(6) Objective 6:

To determine the logistical support requirements generated by the rifle company.

(7) Objective 7:

To investigate techniques of aerial resupply and maintenance of the rifle company.

b. The PENTANA-Type Artillery Support phase of the experimentation had as its objectives:

(1) Objective 1:

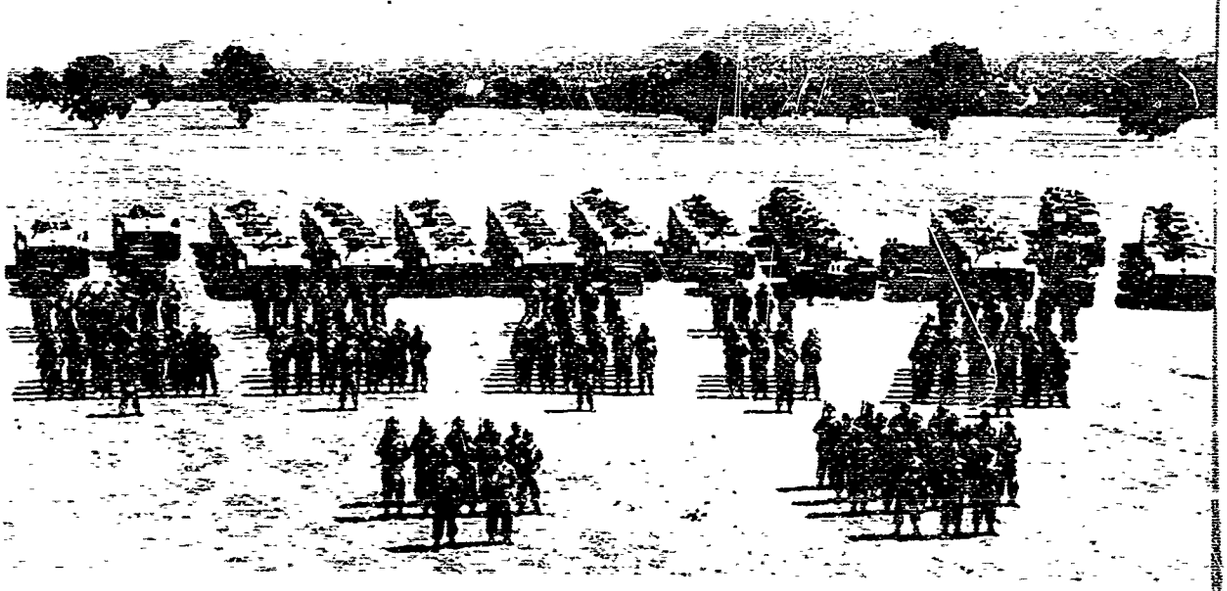
To determine the overall requirements of the combat group for accurate, timely, and continuous artillery support over frontages which vary from relatively narrow to very broad, taking into consideration increased lethality of artillery ammunition and availability of nuclear weapons.

(2) Objective 2:

To determine within the framework of the conditions outlined under Objective 1 above:

(a) The capability of the combat group artillery battery to support the combat group.

(b) Requirements for augmenting the combat group artillery battery with additional artillery organic to the combat group.



Further Attachment of Close Support Artillery and an Additional Rifle Platoon

Availability of Helicopters
for Lift of Combat Elements

Aerial Resupply
and Maintenance
of Rifle Company

(c) Requirements for additional artillery support for the combat group beyond that indicated in (a) and (b) above.

(3) Objective 3:

To determine the logistical support requirements generated by the combat group artillery battery.

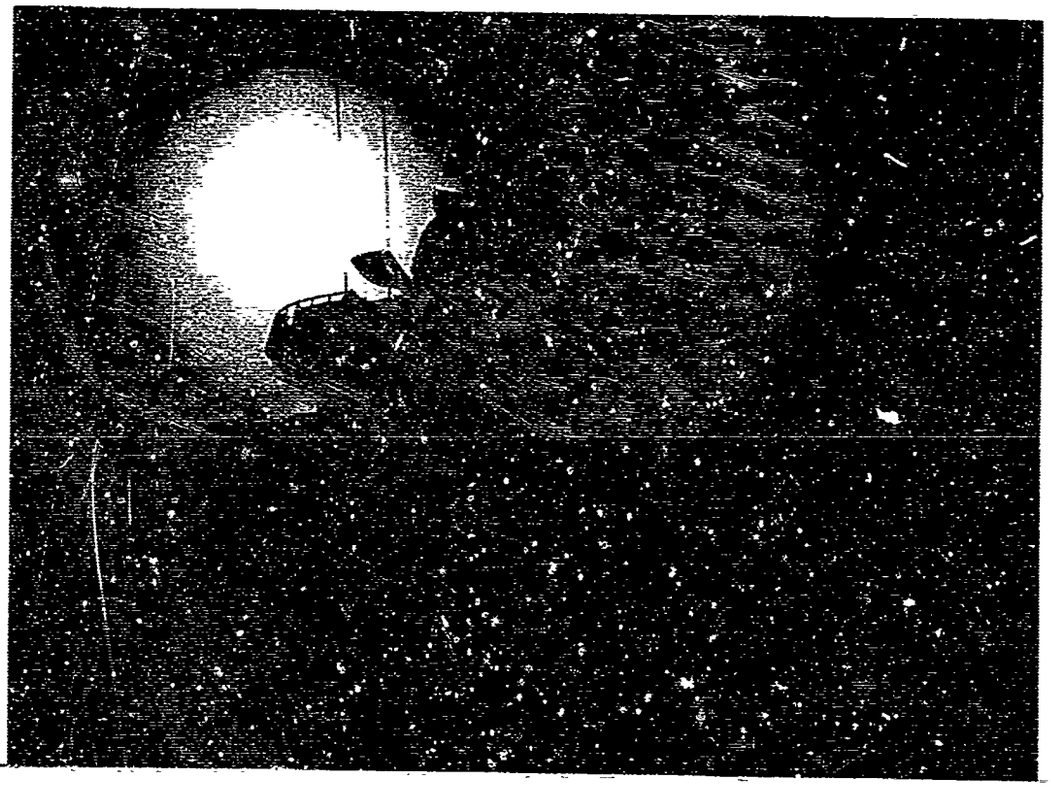
(4) Objective 4:

To determine the requirements for positioning of the combat group artillery battery to insure the accomplishment of the artillery support mission, simultaneously, to achieve the required amount of security from infantry units without diverting these units from their primary mission.

(5) Objective 5:

To determine the capability of the combat group artillery battery to acquire targets and assist in the surveillance effort of the combat group.

The experiment covered daylight offensive
and defensive operations . . .
. . . and night offensive operations.



SCOPE

5. (OFLUSE) Scope:

a. The experiment covered daylight offensive and defensive operations and nightoffensive operations by a PENTANA-Type Company supported by organic combat group artillery and both a direct and indirect nuclear and non-nuclear capability.

b. The basic experiment consisted of 5 weeks of two-sided tactical exercises alternating with weeks of map replay of the tactical exercises to provide concurrent evaluation and where appropriate corrective modification of the experiment. The first week of experimentation provided essentially a final examination to check the training and preparedness of the experimental companies, aggressor task force, and the umpire-controller-evaluator organization. The remaining 4 weeks constituted record experimentation in accordance with the experimental design and included two experimental runs over each of four record courses.

c. Each record week consisted of participation by the two experimental companies in two record runs of two days and one night duration. The scenario was identical for each of these record runs. Insofar as possible aggressor action was duplicated on the two record runs during the week. In this manner a weekly comparison of the two experimental companies, candidate headquarters, and candidate command ranks was possible.

d. From the infinite possibilities of spans of control and operation, three were selected deliberately to insure, if possible, that the potential performance capabilities of the candidates would be bracketed rather than selecting narrower spans of operation and fewer attachments which might fail to tax the full

capabilities of the headquarters or command ranks. Each record run consisted of seven tactical situations. Situations 1 and 2 were daylight offensive and defensive situations in which the companies competed without attachments on frontages and depths of 2500-3500 yards. Situations 3 and 5 were daylight offensive and defensive situations on frontages and depths of 3500-8000 yards with two attachments to the company. Situation 4 was a night offensive action under similar corditions of span and organization as Situations 3 and 5. In Situations 6 and 7 the company was given four attachments to cover frontages and depths of 8000-12000 yards offensively and defensively in daylight operations.

e. During experimentation a determination was made as to whether the experimental company had been successful or unsuccessful in accomplishing the mission assigned for each situation. Specific mission accomplishment in terms of destruction of enemy forces, critical enemy installations, seizure and occupation of commanding terrain, or defense of commanding terrain, was a requirement in each experimental situation. A reasonable time was allowed for the accomplishment of each specific mission based generally on the logical time required for reinforcement of either contestant, as appropriate, or implementation of the action that the experimental unit was attempting to prevent or achieve. Partial mission accomplishment was considered only in the isolated cases when night fell prior to a complete determination of successful or unsuccessful mission accomplishment. In these cases partial mission accomplishment was used to prognosticate mission accomplishment based on recorded data and military observations at the time of situation termination. The following criteria generally governed the determination of success or failure in mission accomplishment.

(1) Destruction of the opposing force or installation, seizure of assigned objective, or defense of commanding terrain within the allowed time and within the casualty criteria described in paragraphs (2) and (3) following.

(2) Achievement of destruction of 50% or more of the defending Aggressor force during the first half of the allowed time while the offensive Experimental force retained a two to one preponderance of force at the time of this achievement.

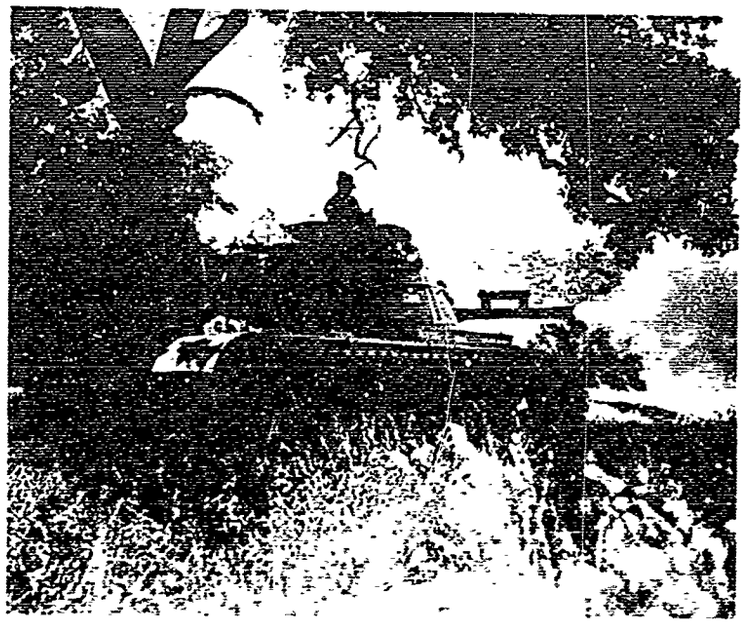
(3) Achievement of destruction of 50% or more of the offensive Aggressor Force during the first half

of the allowed time while the defensive Experimental Force retained a parity of force at the time of accomplishment.

f. Actual experimentation was conducted in consonance with organizational and operational concepts envisioned in the mid-range period (PENTANA PHASE I). Examination of the organization of the rifle company headquarters, rank of the commander, span of control, span of operations, communications, logistical techniques and combat logistical support requirements and tactical concepts were of primary interest.

g. The PENTANA-Type Artillery Support Experiment was conducted concurrently with the Controllability of PENTANA-Type Companies in Mobile Operations Experiment. This experiment was exploratory in nature and designed to obtain data for determination of the capability of the combat group artillery in varied mobile operations against a live aggressor. The combat group artillery battery was employed in a close support role by battery and in platoon combinations.

h. The detailed plan of experimentation is available on a loan basis at Headquarters, Combat Development Experimentation Center, Fort Ord, California.



Supported fires were directed at known or suspected enemy positions.

Small mounted elements initiated action to determine enemy locations, disposition, composition and strength.

TACTICAL CONCEPT

6. (OFLUSE) Tactical Concept:

a. The basic doctrine under which the experimental units were organized and trained envisioned the PENTANA Company operating as part of the combat group in the conduct of offensive and defensive operations. Its 100% armor-protected mobility permitted rapid movement and afforded protection against indirect non-nuclear fires.

b. In offensive action the company advanced generally in multiple columns. When enemy contact was made, observers moved to observation points from which appropriate supporting fires were directed at known or suspected enemy positions. Small mounted elements initiated action to determine enemy locations, disposition, composition, and strength. This reconnaissance action was designed to render more effective future actions of the friendly unit, such as more accurate positioning of organic and supporting non-nuclear strikes. The enemy was normally destroyed by firepower at long or medium ranges.

c. Defense by the PENTANA Company was characterized by the positioning of mobile elements on likely avenues of approach into an area. Observation was maintained forward of and within the battle area to provide early warning of the enemy approach. The enemy was brought under increasingly heavy nuclear and direct fires as he approached. Elements in the path of the enemy advance were withdrawn before becoming engaged in close combat and were shifted to planned positions deeper in the company area or along the flanks of the enemy penetration. Continuous observation was maintained over the enemy.

d. In the field, the experimental forces were allowed freedom of maneuver, within the limitations of a normal combat group order. The free play of nuclear weapons for observed targets was permitted both forces. Area targets were permitted both forces under specified conditions. In view of the obvious impact of aerial reconnaissance and observation on tactical operations and the fact that it would be impossible to provide this capability as a constant factor throughout the experiment because of weather and aircraft maintenance requirements, neither side had access to reconnaissance or observation aircraft. Changes in tactics by both forces were permitted and encouraged from record week to record week.

e. Tactics improved rapidly as the units learned by experience. In the offensive, trends toward keeping antitank weapons well forward became more apparent with each record run. Forward movement, while rapid, became more cautious, with fewer vehicles being exposed within a given area. The advantage in keeping observers on dominant terrain features was realized quickly. The speed and force with which the aggressor advanced emphasized the necessity for defensive organization in depth. Refinements of techniques of withdrawal were developed to permit forcing of the enemy to concentrate long enough and in such numbers as to present a lucrative nuclear target, yet allowing rapid exit from the area.

EXPERIMENTAL AND AGGRESSOR UNITS

7. (OFLUSE) Experimental and Aggressor Units:

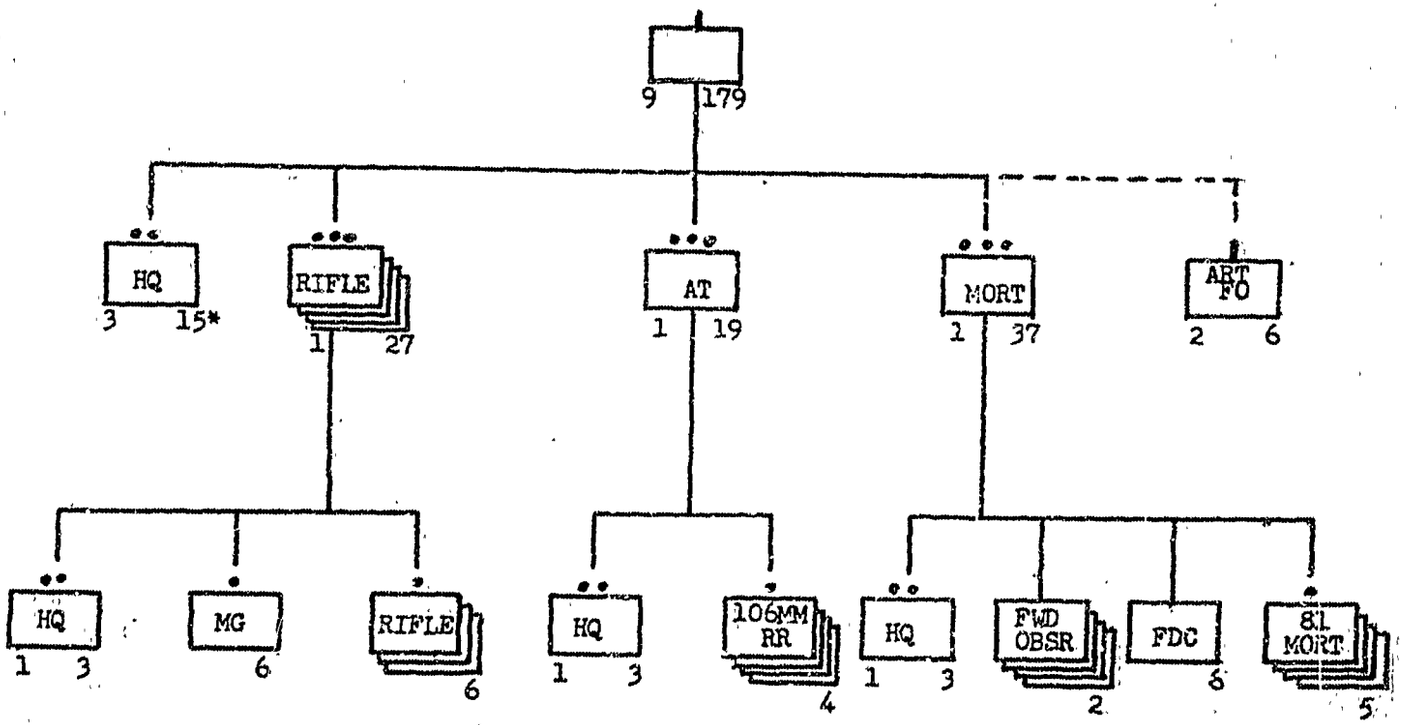
a. Organizational Variables:

During the experiment the two PENTANA-Type Companies were organized and equipped as indicated in Figure 1. On each course the companies operated over several spans of operations with varying numbers and types of subordinate elements including an anti-tank guided missile section and tank platoon (Figure 2) in Situations 3, 4 and 5, and an artillery platoon and an additional PENTANA-Type Rifle Platoon in Situations 6 and 7 (Figure 3).

b. During the experiment two PENTANA-Type Rifle Companies were used. They were opposed by a mechanized aggressor task force supported by indirect nuclear and non-nuclear fires. Two types of rifle company headquarters were employed. Headquarters 1 was an organic PENTANA-Type Rifle Company Headquarters. Headquarters 2 was the same as Headquarters 1 except for the addition of a reconnaissance and operations officer, a reconnaissance sergeant, two radio-telephone operators, and two vehicle drivers. Additional communications equipment provided for Headquarters 2 consisted of two AN/VRC-18 radios. These headquarters were commanded alternately by one of four different captains and four different majors.

c. One platoon of artillery was employed throughout all situations to represent the proportionate share of the normal combat group artillery support. In the first two situations this artillery platoon represented a complete battery. The artillery was employed in a close support role in all of the situations except

PENTANA COMPANY ORGANIZATION
(BASIC)



* STRENGTH OF HQ 2. HQ 1 HAS ONE LESS OFFICER AND FIVE LESS EM.

Figure 1

the last two in which it was attached to the rifle company. For purposes of experimentation, the non-nuclear artillery used was credited with the characteristics of the howitzer.

d. Administration:

The organizations as utilized made no provisions for administration, mess, supply or maintenance in consonance with the PENTANA Concepts of administrative and logistical support from the rear. These services were provided from other services available to Control Headquarters Experimental Troops.

e. Type Headquarters:

Two types of PENTANA-Type Rifle Company Headquarters Organizations were provided. Headquarters 1 was a standard PENTANA Rifle Company Headquarters whereas Headquarters 2 was a standard PENTANA Rifle Company Headquarters augmented with one reconnaissance and operations officer, one reconnaissance sergeant, two R/T Operators and two vehicle drivers.

f. Aggressor Unit:

The aggressor task force was organized to include units shown in Figure 4.

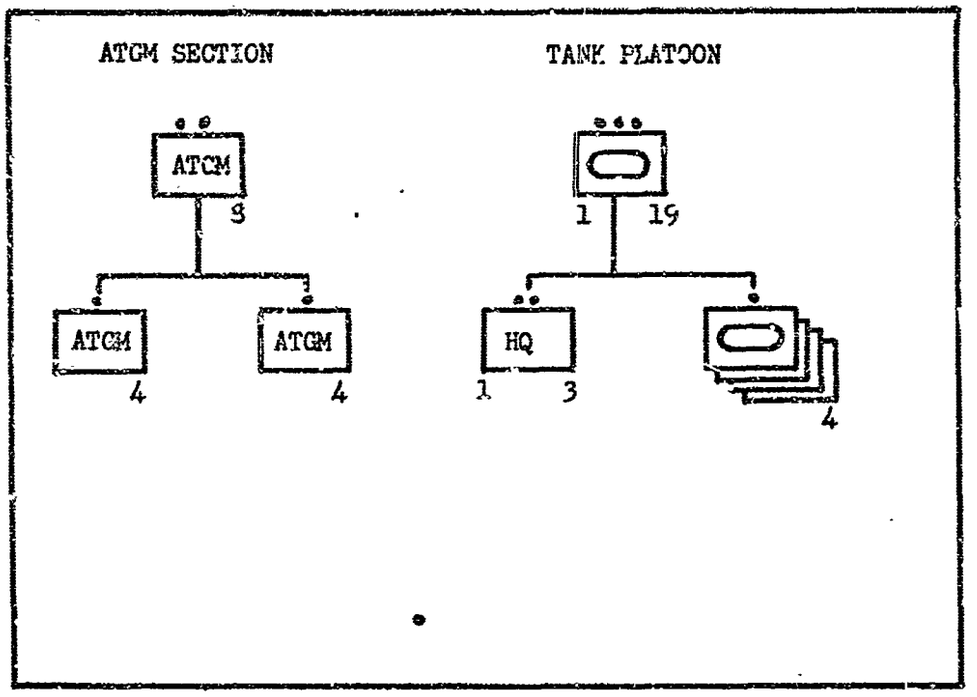


FIGURE 2

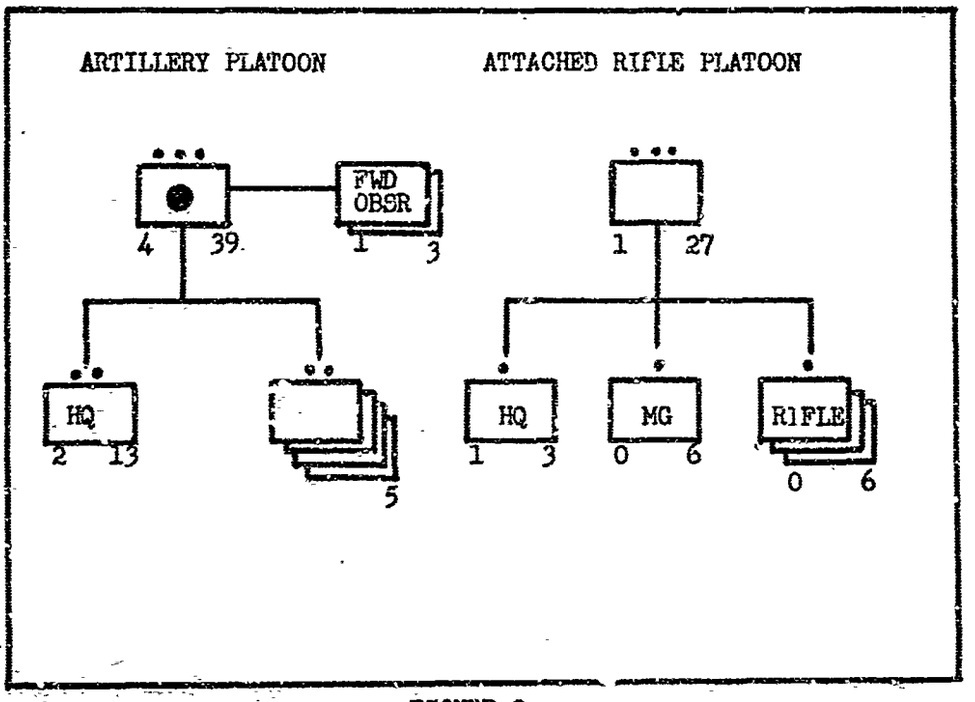


FIGURE 3

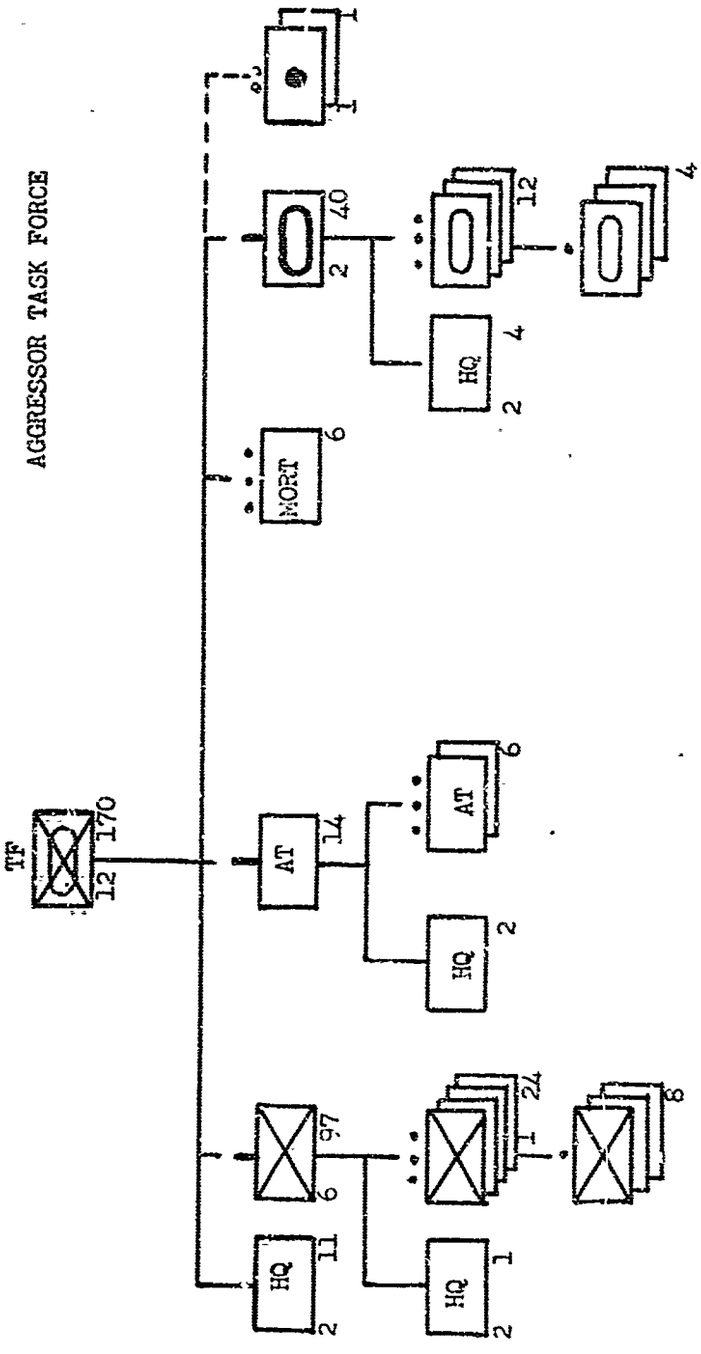
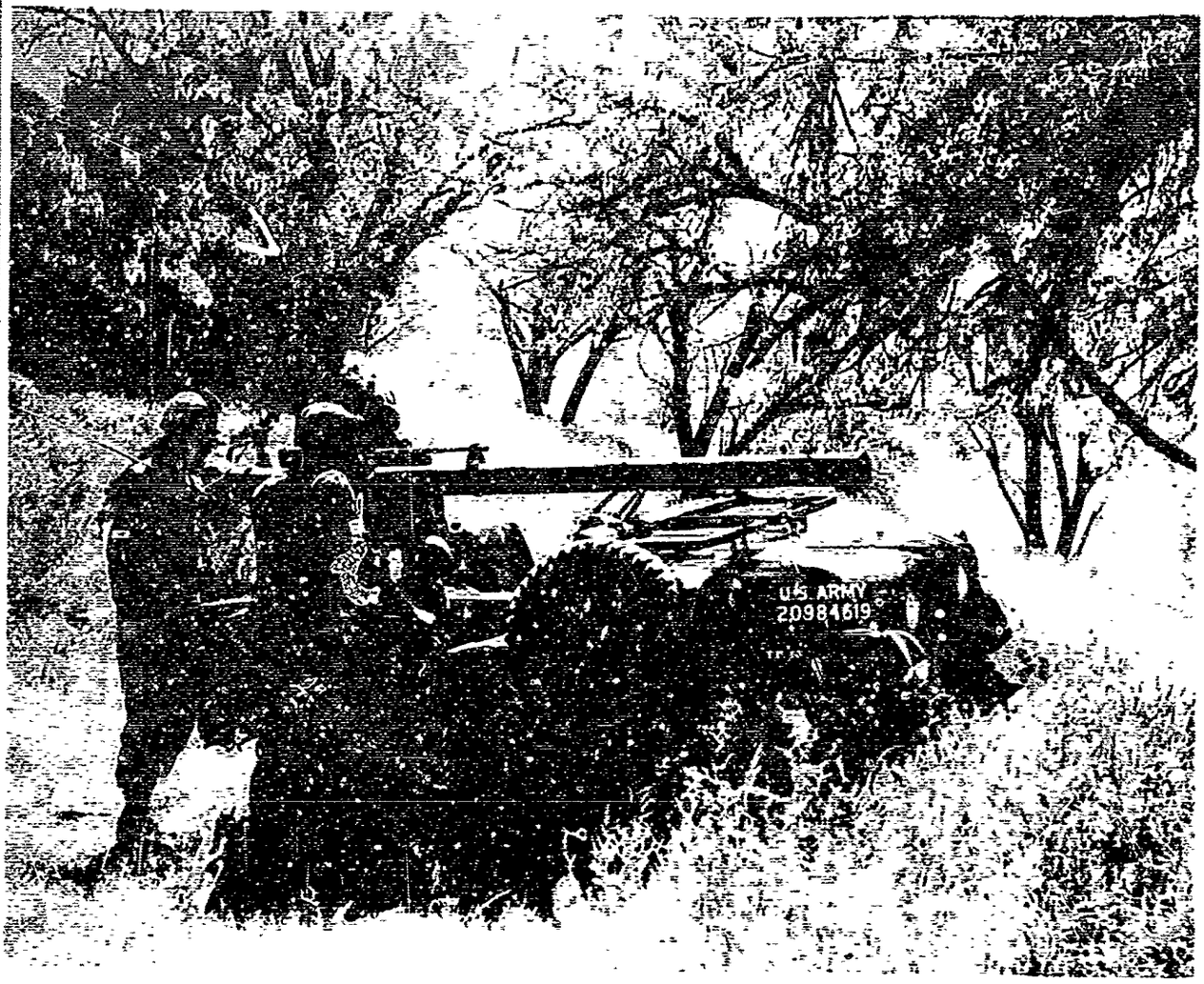

AGGRESSOR TASK FORCE
TF
12
170
AT
14
6
AT
2
HQ
97
6
24
1
8
HQ
11
2
HQ
1
2
MORT
6
40
2
12
4
HQ
4
2

FIGURE 4



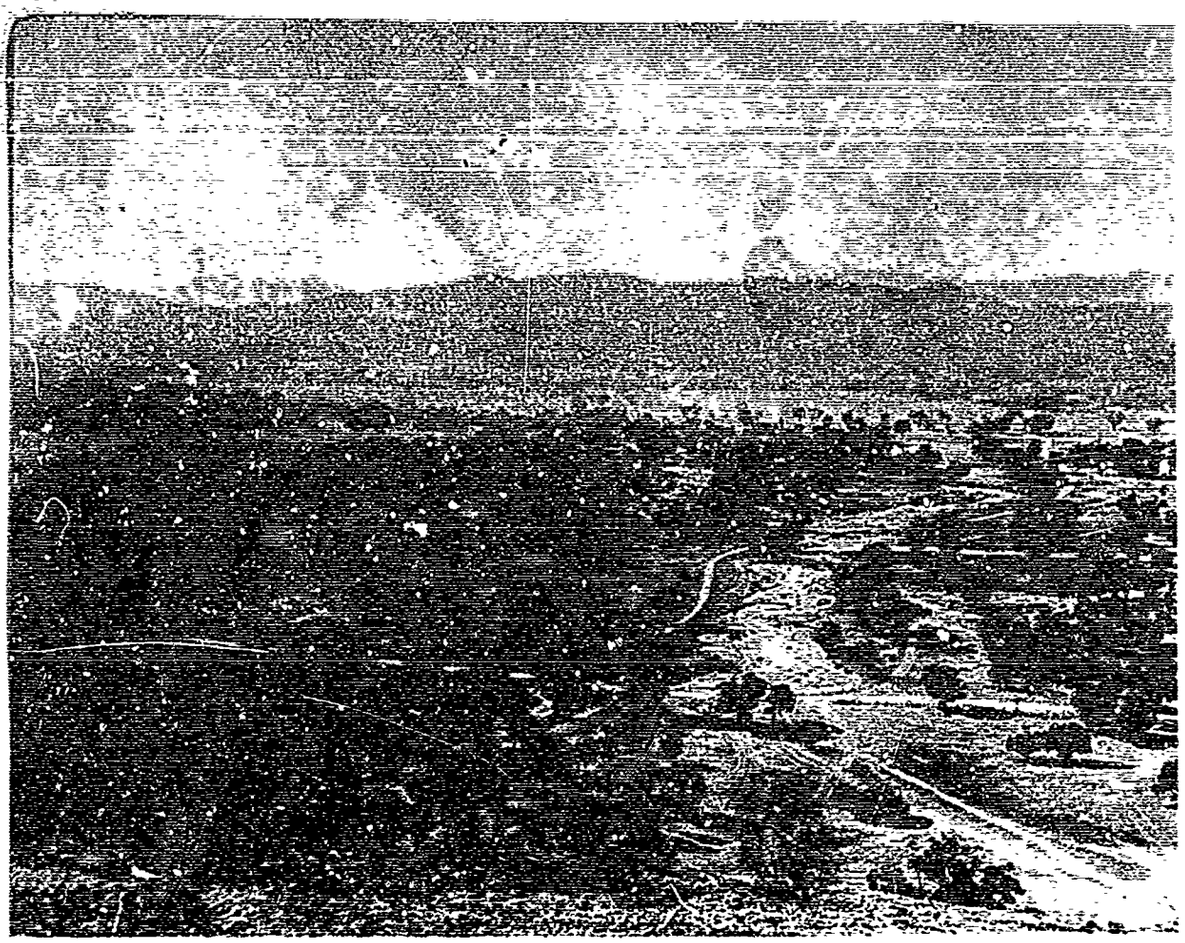
The Experimental Company was opposed by a mechanized Aggressor Task Force, supported by indirect nuclear and non-nuclear fires.

TERRAIN

8. (U) Terrain:

a. The Hunter Liggett Military Reservation is an area of varied terrain ranging from flat open valleys to steep, brushy, partially wooded mountains. The vegetation provided a considerable degree of concealment for dismounted troops and vehicles if positions were carefully selected. Throughout most of the area tracked vehicles had almost unlimited cross-country maneuverability during the experimental period; however, they were forced to cross over primary highways at designated crossing points. This created a degree of artificiality in the experimentation since both sides were aware of these sites.

b. The weather generally was warm and dry and visibility was excellent. However, due to the arid climatic conditions, clouds of dust were raised by the slightest vehicular movement and extreme measures were necessary to prevent disclosure of location and movement. The road network, varying from hard-surface all-weather roads to tank trails and fire breaks, exhibited the same dust characteristics except for the metalled roads, which were restricted to wheeled vehicles only and had little or no effect on the experiment. Natural obstacles of the area are primarily several creeks and small rivers and canyons with sides steep enough to cause wheeled vehicles to be generally road bound.



Hunter Liggett Military Reservation terrain varies from flat, open valleys to steep, brushy, partially wooded mountains.

c. The usable area of HLMR when matched with the expanded zone of operations and duration of each experimental run precluded the allocation of a separate terrain area for each course. It was therefore necessary to utilize the same general terrain area for all courses. However, to minimize the "familiarization" factor on the part of subordinate elements and leaders of the experimental companies, differing directions, routes of approach and objective areas were selected for each record course.

SCENARIOS

9. (OFLUSE) Scenarios:

a. Scenario plan (Figure 5).

b. To provide a basis for analysis and comparison, the scenarios provided that:

(1) Two experimental runs would be conducted each week.

(2) Each company would begin each course with six subordinate elements (organic) operating over a frontage of approximately 2500-3500 yards, increasing to eight subordinate elements at approximately 3500-8000 yards, and to ten subordinate elements at approximately 8000-12000 yards.

(3) Each company would participate in a defensive and offensive situation at each span of operations.

(4) Each experimental run would include both day and night operations during two days and one night.

(5) Record experimentation would be conducted on alternate weeks, providing one week between each two experimental runs for the review and analysis of experimentation, incorporation of any changes indicated, and preparation for succeeding experimentation.

SCENARIO PLAN

SIT	ORIGIN	TYPE OPERATION	MISSION	SPAN (In Yds)	ARTY SUPPORT
I	PENTANA Company No attachments	OFF	To conduct reconnaissance in force to locate and destroy enemy installation.	2500-3500	Btry, close spt
II ..	PENTANA Company No attachments	DEF	To conduct a defensive action to force aggr into an atomic ambush.	2500-3500	Btry, close spt
III ...	PENTANA Company Atchd: 1 Tk Plt 1 ATC Sec ** 1 Hcptr Plt	OFF	To attack and destroy aggr elements; to deny routes and areas to other aggr elements.	3500-8000	1 Plt, close spt of Expr Co and D Co
IV	PENTANA Company Atchd: 1 Tk Plt 1 ATGM Sec	OFF *	To conduct reconnaissance in force during hrs of darkness using various types of illumination.	3500-8000	1 Plt, DS of Co
V	PENTANA Company Atchd: 1 Tk Plt 1 ATGM Sec	DEF	To conduct defensive action to destroy aggr force w/aid of nuc/dev.	3500-8000	1 Plt, DF of Expr Co and D Co
VI	PENTANA Company Atchd: 1 Tk Plt, 1 ATGM Sec, 1 R Plt, 1 Arty Plt	OFF	To conduct reconnaissance in force to locate and destroy aggr forces defending area.	8000-12000	1 Plt atchd to Co
VII ..	PENTANA Company Atchd: 1 Tk Plt, 1 ATGM Sec, 1 R Plt, 1 Arty Plt	DEF	To conduct defensive action to establish defensive position from which to destroy aggr forces w/nuclear devices.	8000-12000	1 Plt atchd to Co
				* Night Operation ** H-21 Helicopter	

Figure 5

(6) Commanders would employ all elements of the unit in each situation.

(7) Units would be reconstituted after each situation to maintain the troop strength factor constant.

TIME FRAME

10. (U) Time Frame:

a. Preparatory Phase: 20 January - 19 May 1958

The preparatory phase was used for completion of organization and for training necessary to provide efficient operation of experimental companies, aggressor units, and controller personnel. Range instrumentation was also completed during this phase.

b. Record Phase: 20 May - 18 July 1958

The record phase of the experiment was used to conduct each experimental company through the record courses. Sufficient time was available after each record course for the conduct of any training required to correct deficiencies noted.

EXPERIMENTAL DESIGN

11. (OFLUSE) Experimental Design:

a. Scientific members of the project team prepared the experimental design which provided for an unbiased comparison of the major variables of classification. The maximum number of situations permitted by experimentation time were included in the design to maximize the chance of detecting differences between the variables if they existed. The design prescribed the order of events and the combination of variables in each run.

b. In addition to the major variables of headquarters and command rank, certain other variations were accounted for in the design. These were:

(1) The week-to-week changes in the terrain courses.

(2) Week-by-week modifications in the scenario.

(3) Capability differences between experimental companies.

(4) Learning by the aggressor task force.

Although the design was flexible as to these variables, only these were permitted and only in a specific preconceived manner. Every effort was exerted to achieve a definite pattern of similarity by situation within each week by issuing the same type directive to each company and requiring both aggressor and experimental companies to initiate action from the same location on the ground during the second run of a record week as were employed in the initial run of that week.

c. Simultaneously with development of the experimental design by the scientific members of the project team, areas of military evaluation were determined to direct the observations of the controllers to those items germane to the objective. One purpose of military observation and evaluation was to supplement and explain the reasons for variations in data gathered for scientific analysis.

CONTROL

12. (OFLUSE) Control:

a. Military evaluator-controller units were developed and trained to insure effective experimental control and accurate data collection. A comprehensive list of military and scientific indicators was prepared to insure the analysis of all pertinent data required for fulfillment of the stated purposes of the experiment.

b. The allocation of controller-evaluator personnel is shown in Figure 6. A total of 27 controller teams were used to collect the scientific data and military information during each record run. The controller team generally included the controller, one radio operator, one recorder, and the driver. The team utilized a 3/4 ton vehicle equipped with an AN/GRC-19 radio (for contact with other controllers and the Experiment Operations Center), an RT-68 or RT-66 radio (for monitoring the command frequency of the experimental unit) and an RT-67 radio (for contact with assistant controllers riding in the tactical vehicles of the supervised unit).

c. The officer controller functioned as combination problem controller, umpire, and military evaluator. As problem controller, he maintained contact with controllers of the opposing elements and the Experiment Operations Center (EOC). Thus, based on a thorough knowledge of the scenario, the controllers of the opposing platoons could anticipate the development of the situation and relay pertinent information as to the disposition and planned actions of the units they were supervising. As contact became imminent, they could anticipate the exchange of direct fires and facilitate the umpiring of such fires. Contact with the EOC was

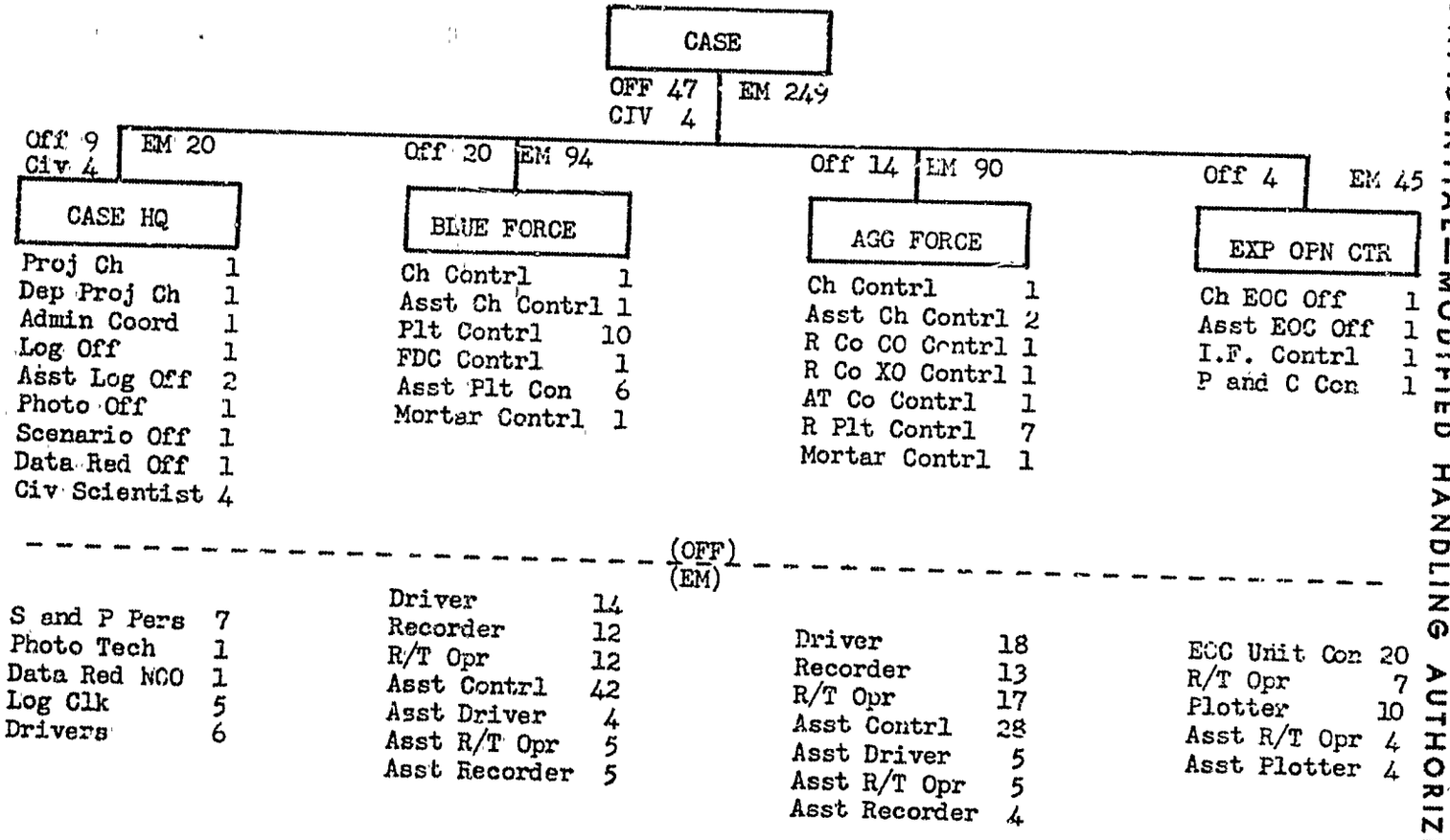


FIGURE 6

maintained for the recording at the EOC of a location plot of all platoon-sized units at all times.

d. As an umpire (and data recorder) the officer controller maintained a complete record of times and locations of all activities of his unit and participated as a link in the direct and indirect fire control system.

e. In fulfilling his function as a military evaluator, the officer controller made appropriate observations and maintained complete check sheets to provide necessary information of a subjective nature for subsequent analysis and evaluation.

f. The officer controller with each tactical unit was the principal agency for the collection of data for scientific analysis. In consonance with this mission he maintained an accurate Controller Map Plot with the unit center of mass plotted at 10 minute intervals; the Controller Journal showing a chronological record of significant events or actions for the element or elements being controlled, and a Direct Fire Data Card.

Contact with the Experiment Operations Center was maintained for the recording at the E.O.C. of a location plot of all platoon-sized units at all times.

EMPLOYMENT OF

NUCLEAR WEAPONS

13. (C-MHA) Source of Nuclear Delivery Means:

Nuclear artillery fires in the experiment were made available at division level. This type of artillery fire was available during all situations of the experiment as prescribed by the scenario. Requests for nuclear fire were processed through normal artillary channels, i.e., observer to FDC to division (Experiment Operations Center).

a. Targets Considered Appropriate for Nuclear Weapons:

As guidance for the experimental company and the indirect fire FDC, no target smaller than a rifle platoon was to be considered an appropriate nuclear target. The rifle platoon was considered to be 4 - 5 vehicles grouped within the destruction zone of the nuclear weapon available for the experiment.

b. Delivery Means:

No specific type of delivery means for the nuclear weapons supporting the experimental and aggressor forces was prescribed. Since the delivery means was not organic to the experimental company it was considered appropriate to prescribe standards of damage radius, safety limits, delivery time and accuracy, and from then through experimentation and analysis of the experimental results develop appropriate delivery requirements compatible with the targets generated.

c. Characteristics:

In order to provide a standard for comparison and analysis the detailed plan for expermentation specified the characteristics for one type nuclear round as listed below:

(1) Delivery time - 10 minutes.

(2) Damage radius - 500 yards.

(3) Safety radius - 1500 yards.

(4) CPE - 100 yards.

d. Quantities Available:

Unlimited.

Nuclear weapons played a dominant role on the battlefield.

RESULTS

14. (U) Results:

a. The discussion and conclusions presented in the following pages are the results of analysis and evaluation derived from an examination of the information resulting from the four record courses of experimentation. Discussions of experimental objectives, together with related conclusions are outlined in the succeeding sections as well as in Volumes II, III and IV. Supplemental conclusions not specifically relating to the experimental objectives are presented and discussed in Section XIII.

b. These discussions and conclusions must be viewed within the framework of the tactical environment employed:

(1) Completely mechanized forces.

(2) Relatively unlimited availability of low yield tactical nuclear weapons.

(3) Unavailability of observation aircraft or tactical air-support to experimental or aggressor force.

(4) Absence of electronic countermeasures.

(5) Constant aggress · strength and capabilities.

c. It is emphasized that the recommendations contained in this report must be considered in combination with tests, studies, war games, etc., conducted by other CONARC combat development agencies.

SECTION II

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 1a

15. Statement of Objective:

To determine the capability of the rifle company operating as part of a combat group, to accomplish daylight offensive missions using reconnaissance in force tactics and non-nuclear and nuclear weapons while operating over extended distances.

16. Indicators:

In the examination of the performance of the PENTANA-type company engaged in offensive operations attention has been directed toward the following areas of study:

a. Frequency of Mission Accomplishment.

b. Casualty Effects.

c. Utilization of Nuclear Devices.

d. Casualties Suffered from Own Nuclear Devices.

17. Presentation of Data:

a. Frequency of Mission Accomplishment:

Para 1d of SCOPE discusses the combination of tactical situations, company organizations, and span of control for each of the record courses. Results obtained were as indicated below:

SPAN	SUCCESSFUL	UNSUCCESSFUL
2500-3500	7	1
3500-8000	4	4
8000-12000	2	6

Figure 7 graphically portrays this data.

b. Casualty Effects:

(1) Figure 8 is a graphical presentation of comparative vehicular casualty rates for each offensive situation, averaged over all record courses and expressed in terms of percent of vehicles remaining at indicated time intervals. Figure 9 reflects similar data averaged over the situations where missions were accomplished and Figure 10 for situations where missions were not accomplished.

(2) Figures 11 and 12 tabulate by experimental company, by course, and by offensive situation the ratio of vehicular casualties inflicted to casualties sustained. Figure 13 tabulates the overall average of these ratios by offensive situation.

c. Utilization of Nuclear Devices:

Figures 14 and 15 provide the data on nuclear devices used by the experimental companies by situation and span that were delivered by indirect means.

d. Casualties Suffered from Own Nuclear Devices:

A graphical portrayal of cost in casualties sustained as the result of the use of nuclear devices is shown in Figure 16.

18. Discussion:

a. Frequency of Mission Accomplishment:

Par 1e of SCOPE discusses the method of determining whether or not missions were successfully accomplished. An examination of the results obtained from the eight offensive situations

at each span of operations encountered in the 4 record runs indicates that the frequency of mission accomplishment decreased with the enlargement of the area of operations. At the intermediate span of operations the company was only successful 50% of the time and that level of success was reduced to 25% at the large area of operations. Consideration of mission accomplishment over the expanded span of operations must take into account the added attachments in the intermediate and larger spans of operations.

b. Casualty Effects:

(1) It appears that the number of vehicular casualties sustained were not influenced to a significant degree by an increase in span of operations. When comparisons are made between spans of operations and casualties sustained on missions rated as successful, the 62% of forces remaining is greatest at the intermediate span of operations; is the least, 38% at the largest span. Successful operations at the narrow span of operations (2500-3500 yards) left 52% of the forces remaining. Even in those operations that were not successful least casualties were sustained in the intermediate span.

(2) Examination of the available data on vehicle casualties inflicted and sustained indicates the most favorable ratio, 1 to 1.11, was obtained in offensive operations at the 3500-8000 yard span. At the 2500-3500 yard span a ratio of 1 to 1.48 was obtained. The least favorable ratio, 1 to 1.79, was obtained at the 8000-12000 yard span.

(3) While mission accomplishment per se indicates that the greatest success was achieved in offensive operations at the 2500-3500 yard span of operations, this indication must now be tempered by the apparent indication that significantly improved ratios of casualties sustained to casualties inflicted and somewhat fewer average total casualties were sustained in operations at the 3500-8000 yard span of operations.

c. Utilization of Nuclear Devices:

The experimental companies employed an average of 7.45 nuclear devices per situation in offensive operations. The average number of nuclear devices used per situation at each span of operations was 6.4, 7.25, and 9.9, respectively. From the nuclear devices used at each span of operations the average vehicular casualties obtained per nuclear fire were 2.29, 1.43 and 1.71. Here again the comparison between the intermediate and narrow span can be made. The narrow span in this case appears to be the environment that promises the most successful offensive exploitation of tactical nuclear weapons. However, from the casualty ratios it is evident that it is also the span where aggressor achieved greatest effects with his nuclear weapons.

d. Casualties Suffered from Own Nuclear Devices:

By span of operations the casualties which resulted from own nuclear fires represented 7.7%, 13% and 11.4% of the total vehicular casualties sustained. Here, the narrow span of operations was clearly the most advantageous.

19. Conclusions:

The PENTANA Company, as organized for the Controllability Experiment, was capable of accomplishing daylight offensive missions as shown below:

a. 2500-3500 yard span of operations: Seven of eight missions accomplished, with an average vehicular casualty rate of 48% over an average mission accomplishment time of nearly 3½ hours.

b. 3500-8000 yard span of operations: Four of eight missions accomplished, with an average vehicular casualty rate of 38% over an average mission accomplishment time of nearly 2½ hours.

c. 8000-12000 yard span of operations: Two of eight missions accomplished with an average vehicular casualty rate of 62% over an average mission accomplishment time of nearly 2½ hours.

20. Recommendation:

For recommendations relative to increasing PENTANA Company capabilities to accomplish tactical missions, see Section XIII.

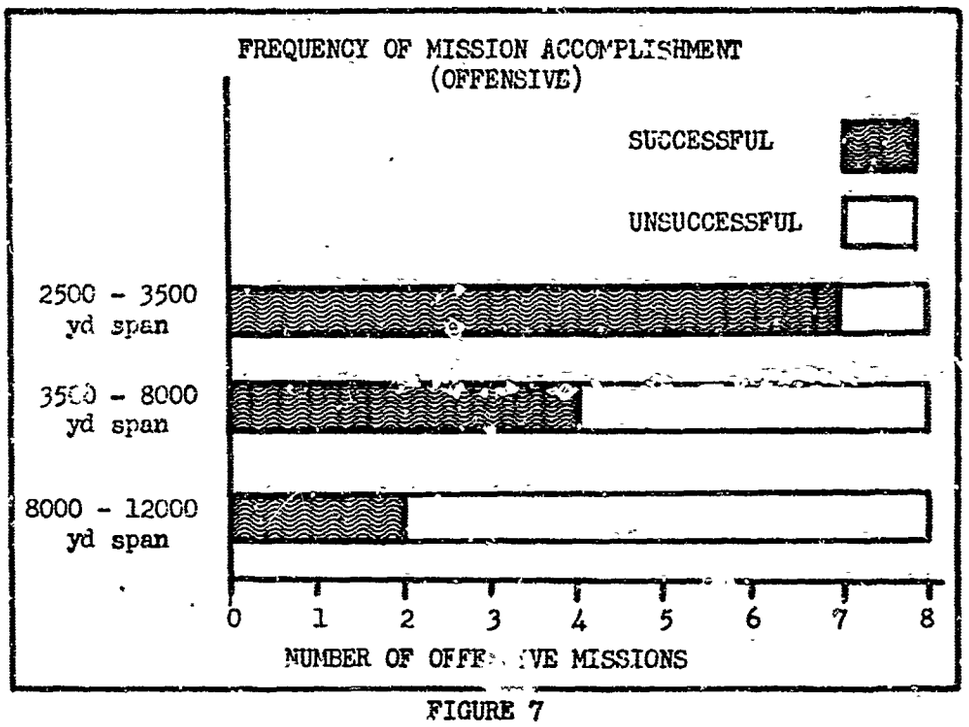


FIGURE 7

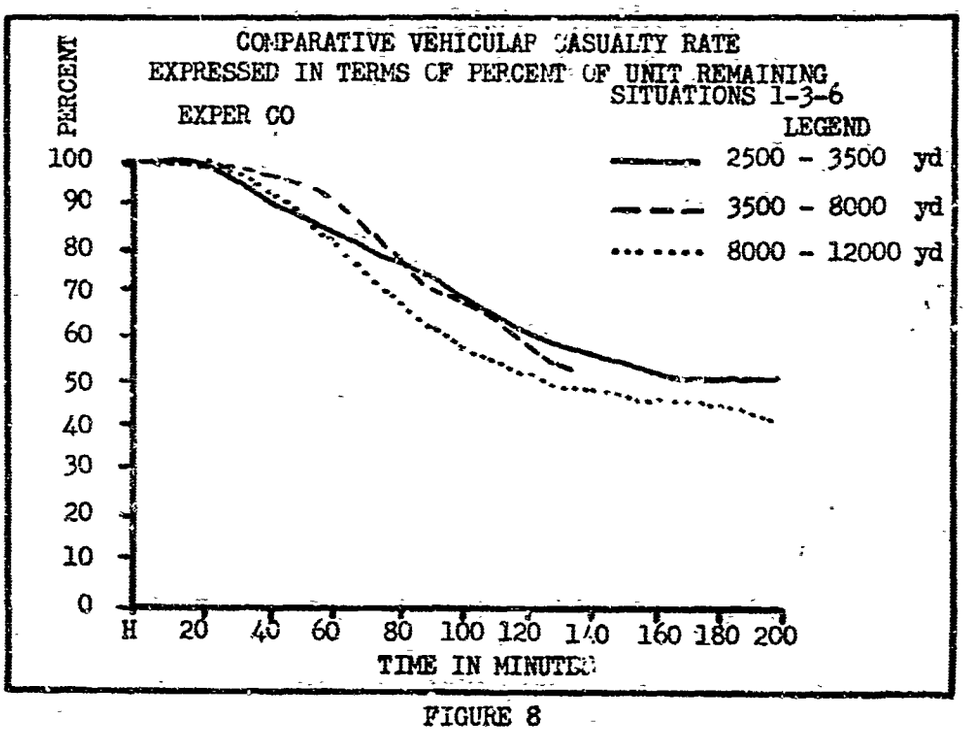


FIGURE 8

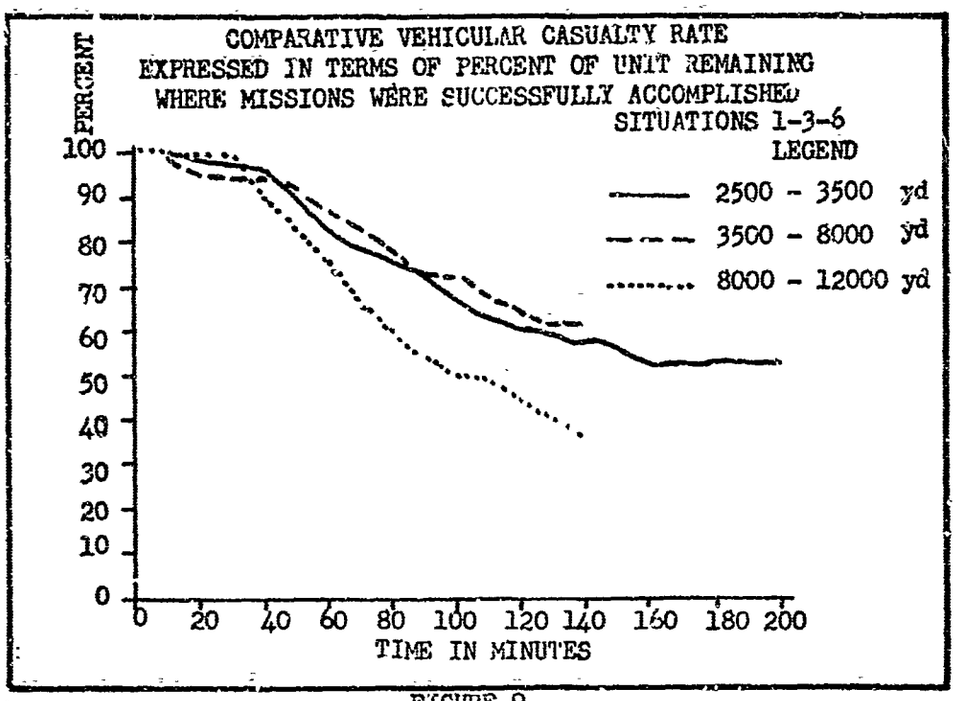


FIGURE 9

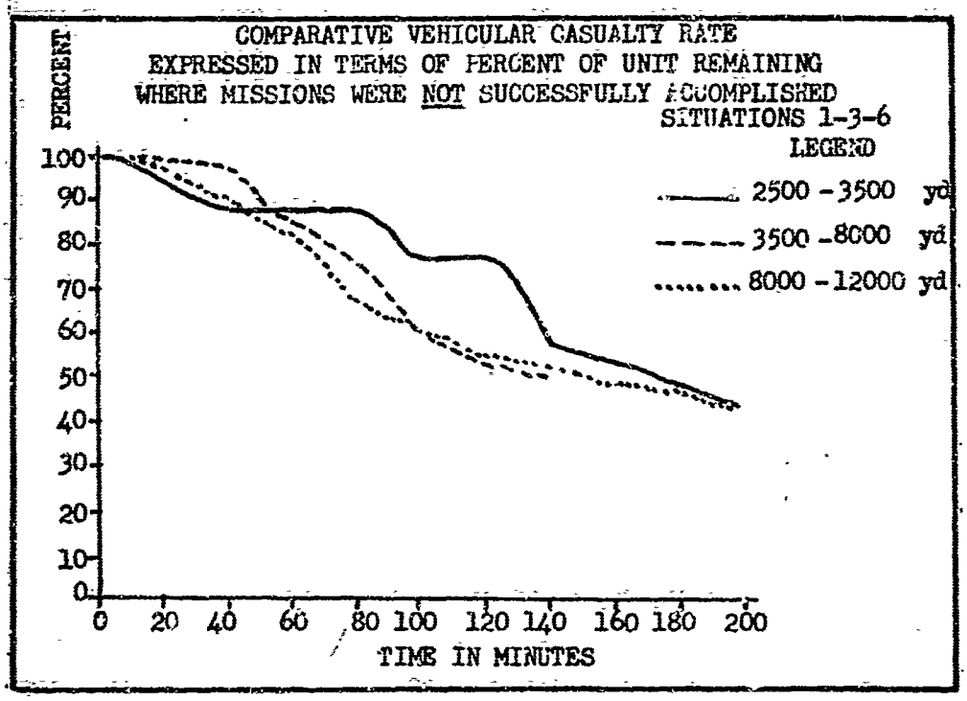


FIGURE 10

RATIO OF VEHICULAR CASUALTIES INFLICTED TO CASUALTIES SUSTAINED - Co A

SITUATION 1

RC I	1 to 1.61
RC II	1 to 0.77
RC III	1 to 1.10
RC IV	1 to 1.50

SITUATION 3

RC I	1 to 2.10
RC II	1 to 1.00
RC III	1 to 1.86
RC IV	1 to 1.22

SITUATION 6

RC I	1 to 2.24
RC II	1 to 1.35
RC III	1 to 1.23
RC IV	1 to 1.45

Figure 11

RATIO OF VEHICULAR CASUALTIES INFLICTED TO CASUALTIES SUSTAINED - CO B

SITUATION 1

RC I	1 to 3.44
RC II	1 to 1.62
RC III	1 to 0.90
RC IV	1 to 2.57

SITUATION 3

RC I	1 to 0.32
RC II	1 to 1.18
RC III	1 to 0.65
RC IV	1 to 1.58

SITUATION 6

RC I	1 to 3.23
RC II	1 to 1.93
RC III	1 to 2.43
RC IV	1 to 1.62

Figure 12

RATIO OF VEHICULAR CASUALTIES INFLICTED
TO CASUALTIES SUSTAINED

AVERAGES OF ALL LIKE SITUATIONS

SITUATION 1

0.68 to 1

SITUATION 3

0.90 to 1

SITUATION 6

0.56 to 1

Figure 13

AVERAGE NUMBER OF NUCLEAR DEVICES PER SITUATION

SITUATION 1	6.4
SITUATION 3	7.25
SITUATION 6	9.9
AVERAGE (ALL SITUATIONS)	7.45

Figure 14

UTILIZATION OF NUCLEAR DEVICES

NUMBER OF NUCLEAR DEVICES - NUMBER OF VEHICULAR CASUALTIES

	SIT 1		SIT 3		SIT 6	
	* N	** C	* N	** C	* N	** C
RC I	7	23	7	16	9	22
RC II	17	35	10	15	24	33
RC III	14	30	29	35	34	35
RC IV	13	29	13	17	12	45

TOTAL NUCLEAR DEVICES SIT 1: 51

TOTAL CASUALTIES SIT 1: 117

TOTAL NUCLEAR DEVICES SIT 3: 58

TOTAL CASUALTIES SIT 3: 83

TOTAL NUCLEAR DEVICES SIT 6: 79

TOTAL CASUALTIES SIT 6: 135

AVERAGE NUMBER OF VEHICULAR CASUALTIES PER NUCLEAR DEVICE

SITUATION 1	2.29
SITUATION 3	1.43
SITUATION 6	1.71

* N - Nuclear Devices

** C - Vehicle Casualties

Figure 15

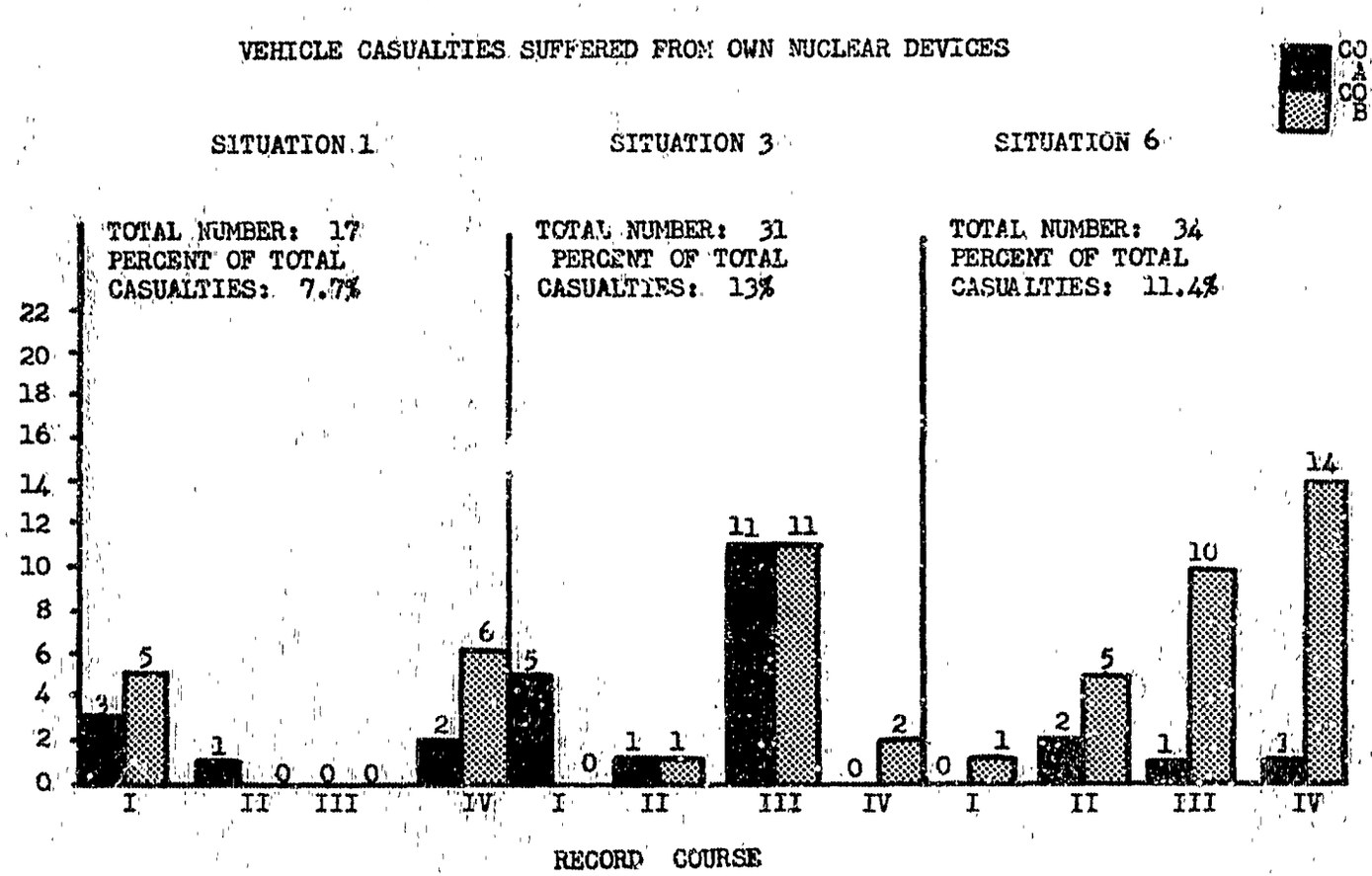


FIGURE 16

SECTION III

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 1b

21. Objective:

To determine the capability of the rifle company operating as part of a combat group, to accomplish daylight defensive missions, using counter-reconnaissance tactics and non-nuclear and nuclear weapons, while operating over extended distances.

22. Indicators:

In the examination of the performance of the PENTANA-Type Company engaged in defensive operations attention has been directed toward the following areas of study:

a. Frequency of mission accomplishment.

b. Casualty effects.

c. Utilization of nuclear devices.

d. Casualties suffered from own nuclear devices.

23. Presentation of Data:

a. Frequency of Mission Accomplishment:

Each experimental company was required to engage in three defensive operations during each record run at spans of operations of 2500 - 3500 yards, at 3500 - 8000 yards and at the maximum 8000 - 12000 yards. Results obtained were as indicated below:

SPAN	SUCCESSFUL	UNSUCCESSFUL
2500 - 3500 yards	2	6
3500 - 8000 yards	6	2
8000 - 12000 yards	6	2

Figure 17 graphically portrays this data.

b. Casualty Effects:

(1) Figure 18 is a graphical presentation of comparative vehicular casualty rates for each defensive situation, averaged over all record courses and expressed in terms of percent of vehicles remaining at indicated time intervals. Figure 19 reflects similar data averaged over the situations where missions were accomplished and Figure 20 for situations where missions were not accomplished.

(2) Figures 21 and 22 tabulate by experimental company, by course, and by defensive situation the ratio of vehicular casualties inflicted to casualties sustained. Figure 23 tabulates the overall average of these ratios by defensive situation.

c. Utilization of Nuclear Devices:

Figures 24 and 25 provide the data on nuclear devices used by the experimental companies by situation and span that were delivered by indirect means.

d. Casualties Suffered From Own Nuclear Devices:

A graphical portrayal of cost in casualties sustained as the result of the use of nuclear fires is shown in Figure 26.

24. Discussion:

a. Frequency of Mission Accomplishment:

An examination of the results obtained from the eight defensive situations at each span of operations encountered in the four record runs indicates that the frequency of mission accomplishment increased with the enlargement of the area of operations. At the intermediate and large spans of operation the company successfully accomplished its missions 75% of the time, whereas the level of success was reduced to 25% at the smaller span of operations. Consideration of mission accomplishment over the expanded span of operations must take into account the added attachments in the intermediate and large spans of operations.

b. Casualty Effects:

The number of vehicular casualties sustained appeared to vary inversely with the spans of operations. As the span of operation enlarged the percentage of vehicular casualties diminished. When comparisons are made between spans of operations and casualties sustained on missions rated successful, the same trend is apparent with the least percentage of forces remaining at the smallest span 60.2%, the largest percentage remaining at the largest span 79.7% and 69% at the intermediate span. In those operations that were not successful it appears that the number of vehicular casualties sustained have no direct relationship to the span of operations except perhaps to confirm the trend indicated by the successful operations inasmuch as the least casualties 27.7% were suffered at the large span, while heavier casualties 40.1% and 42.5% were suffered at the small and intermediate spans.

Examination of the available data on vehicle casualties inflicted and sustained indicates that there is a direct relationship between the ratio of casualties inflicted to casualties sustained and the increase in the size of the area of operations. As the span was increased, the ratio became more favorable. At the 2500 - 3500 span a ratio of 1.21 to 1 is obtained; the ratio of 1.41 to 1 is obtained at the span of 3500 - 8000 yards; while at the 8000 - 12000 yard span the ratio is 1.98 to 1.

c. Utilization of Nuclear Devices:

The experimental companies employed an average of 7.86 nuclear devices per situation in defensive situations. The average number of nuclear devices used at each span of operations was 8.6, 7.25 and 7.5, respectively. From the nuclear devices used at each span of operations the average vehicular casualties obtained per nuclear fire were 1.49, 1.98, and 1.65. The results obtained would appear not to be directly related to the span of operations.

d. Casualties Suffered From Own Nuclear Devices:

By span of operations the vehicular casualties suffered from own nuclear devices represented 20.2%, 16.7% and 9.8% of the total casualties sustained. It would appear that as the area of operations is enlarged the percentage of such casualties declines.

25. Conclusions:

The PENTANA Company, as organized for the Controllability Experiment, was capable of accomplishing daylight defensive missions as shown below:

a. 2500-3500 yard span of operations: Two of eight missions accomplished, with an average vehicular casualty rate of 40% over an average mission accomplishment time of nearly 2 hours.

b. 3500-8000 yard span of operations: Six of eight missions accomplished, with an average vehicular casualty rate of 31% over an average mission accomplishment time of nearly 2½ hours.

c. 8000-12000 yard span of operations: Six of eight missions accomplished, with an average vehicular casualty rate of 20% over an average mission accomplishment time of nearly 1½ hours.

26. Recommendation:

For recommendations relative to increasing PENTANA Company capabilities to accomplish tactical missions, see Section XIII.

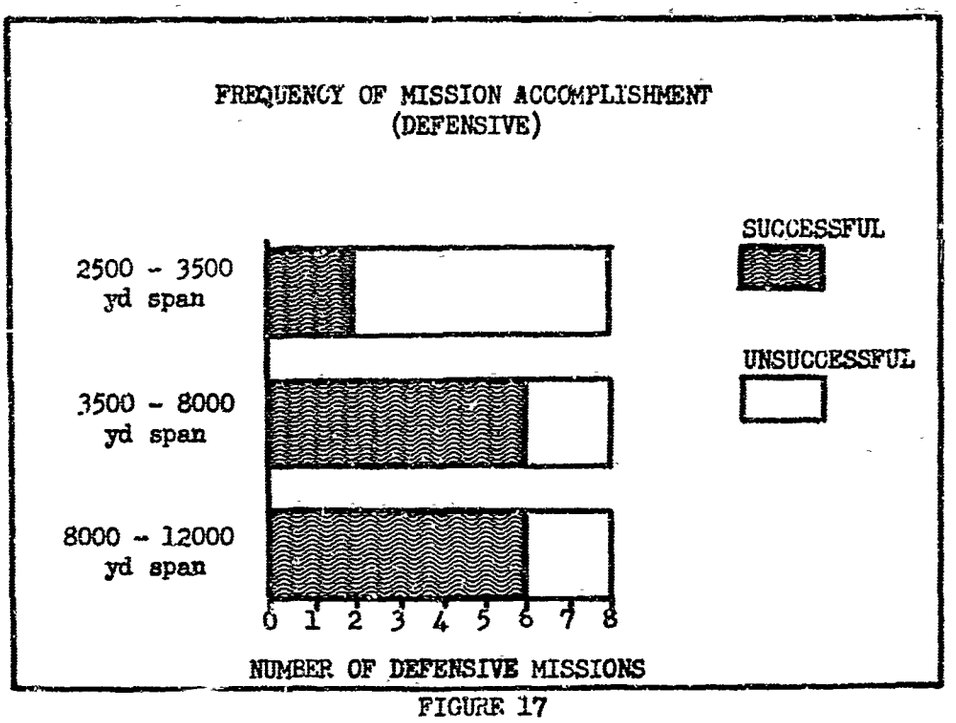


FIGURE 17

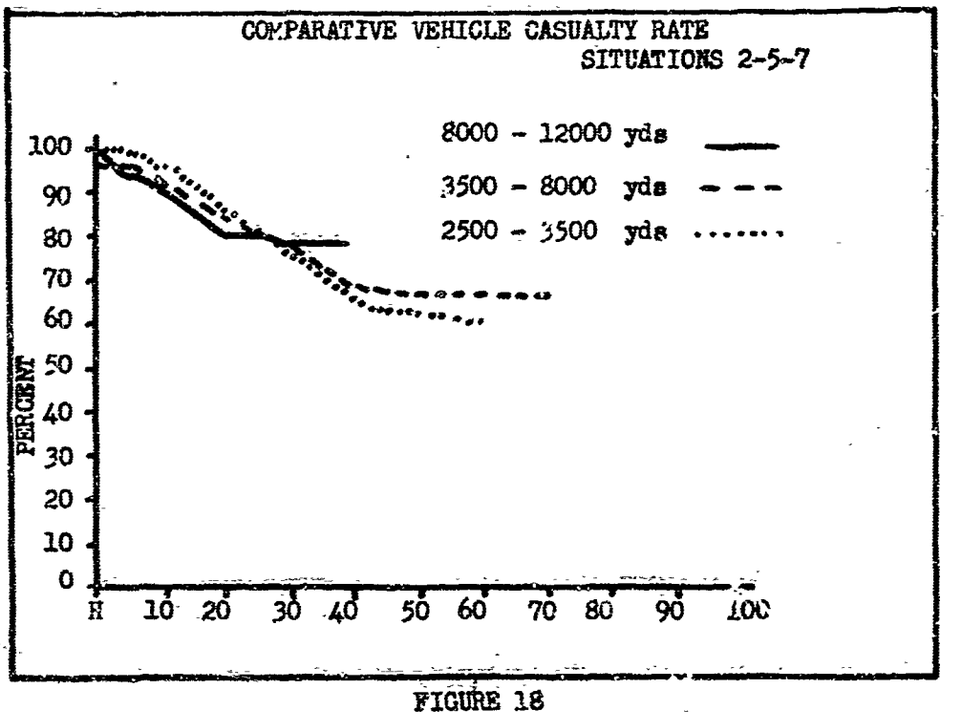


FIGURE 18

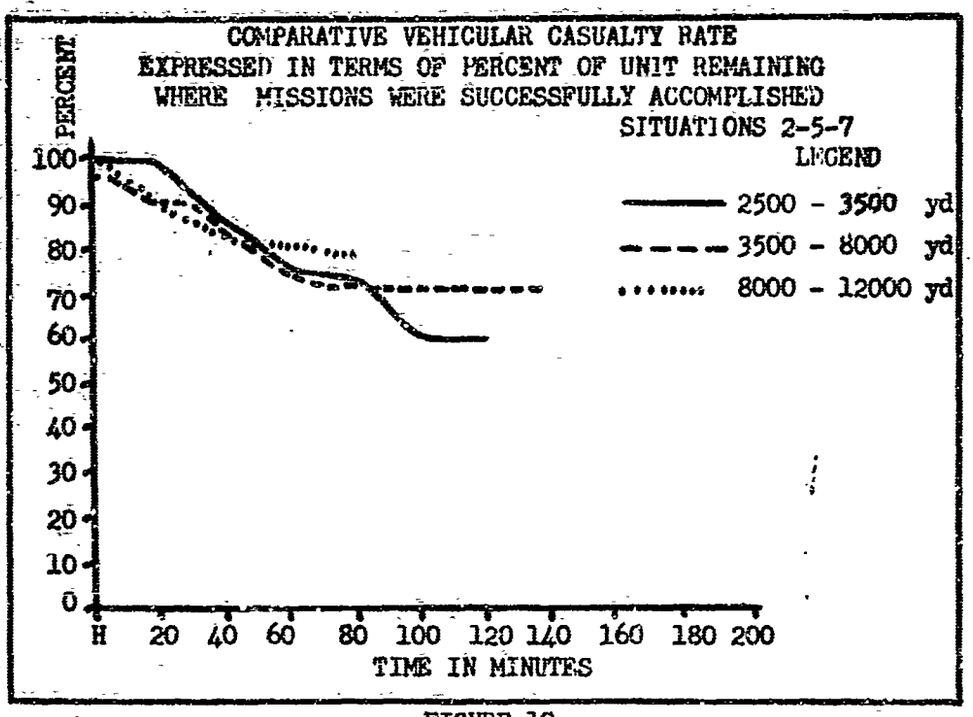


FIGURE 19

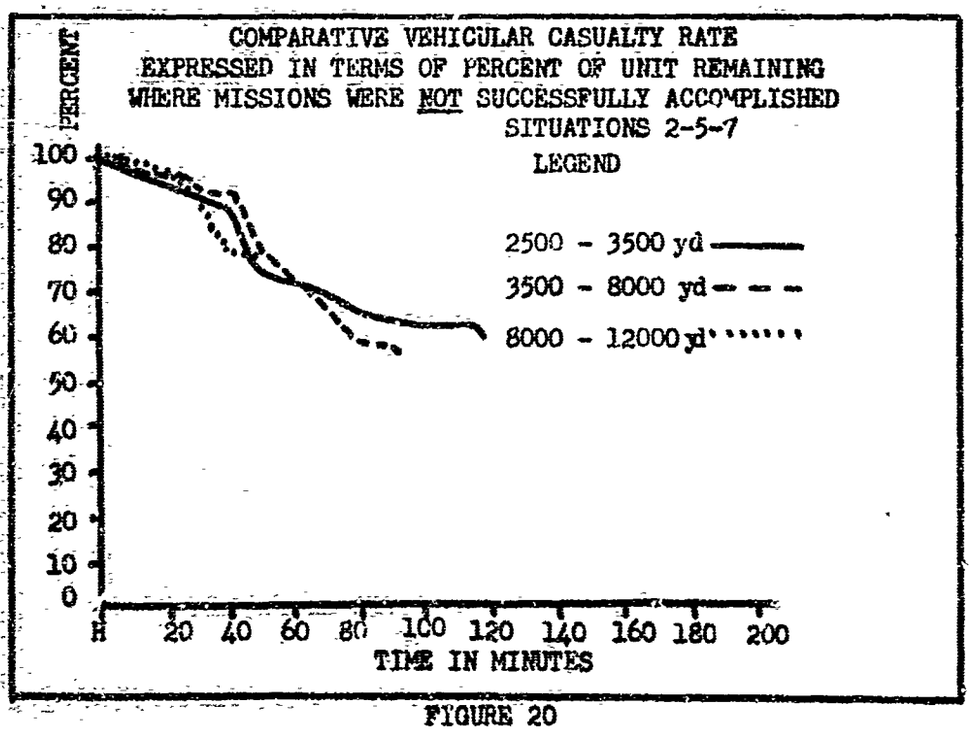


FIGURE 20

RATIO OF VEHICLE CASUALTIES INFLICTED TO VEHICLE CASUALTIES SUSTAINED - CC A

SITUATION 2

RC I	0.58 to 1
RC II	0.80 to 1
RC III	1.46 to 1
RC IV	1.55 to 1

SITUATION 5

RC I	1.93 to 1
RC II	0.76 to 1
RC III	1.27 to 1
RC IV	1.61 to 1

SITUATION 7

RC I	0.74 to 1
RC II	10.30 to 1
RC III	0.84 to 1
RC IV	5.80 to 1

Figure 21

RATIO OF VEHICLE CASUALTIES INFLICTED TO VEHICLE CASUALTIES SUSTAINED - CO B

SITUATION 2

RC I	1.05 to 1
RC II	1.72 to 1
RC III	1.22 to 1
RC IV	1.31 to 1

SITUATION 5

RC I	2.14 to 1
RC II	1.00 to 1
RC III	1.23 to 1
RC IV	2.06 to 1

SITUATION 7

RC I	2.29 to 1
RC II	6.20 to 1
RC III	1.18 to 1
RC IV	2.64 to 1

Figure 22

RATIO OF VEHICLE CASUALTIES INFLICTED
TO VEHICLE CASUALTIES SUSTAINED

AVERAGES OF ALL LIKE SITUATIONS

SITUATION 2

1.21 to 1

SITUATION 5

1.41 to 1

SITUATION 7

1.98 to 1

Figure 23

AVERAGE NUMBER OF NUCLEAR DEVICES PER SITUATION

SITUATION 2	8.6
SITUATION 5	7.25
SITUATION 7	7.5
AVERAGE (ALL SITUATIONS)	7.86

Figure 24

UTILIZATION OF NUCLEAR DEVICES

NUMBER OF NUCLEAR DEVICES - NUMBER OF VEHICULAR CASUALTIES

	SIT 2		SIT 5		SIT 7	
	* N	** C	* N	** C	* N	** C
RC I	5	13	8	36	8	7
RC II	16	22	17	20	17	45
RC III	24	40	20	36	20	24
RC IV	24	28	15	27	15	23

TOTAL NUCLEAR DROPS SIT 2: 69

TOTAL RESULTING CASUALTIES SIT 2: 103

TOTAL NUCLEAR DROPS SIT 5: 60

TOTAL RESULTING CASUALTIES SIT 5: 119

TOTAL NUCLEAR DROPS SIT 7: 60

TOTAL RESULTING CASUALTIES Sit 7: 99

AVERAGE NUMBER OF VEHICULAR CASUALTIES PER NUCLEAR DEVICE BY COMBINING LIKE SITUATIONS

SITUATION 2	1.49
SITUATION 5	1.98
SITUATION 7	1.65

* N - Nuclear Device

** C - Casualties

Figure 25

VEHICULAR CASUALTIES SUFFERED FROM OWN NUCLEAR DEVICES

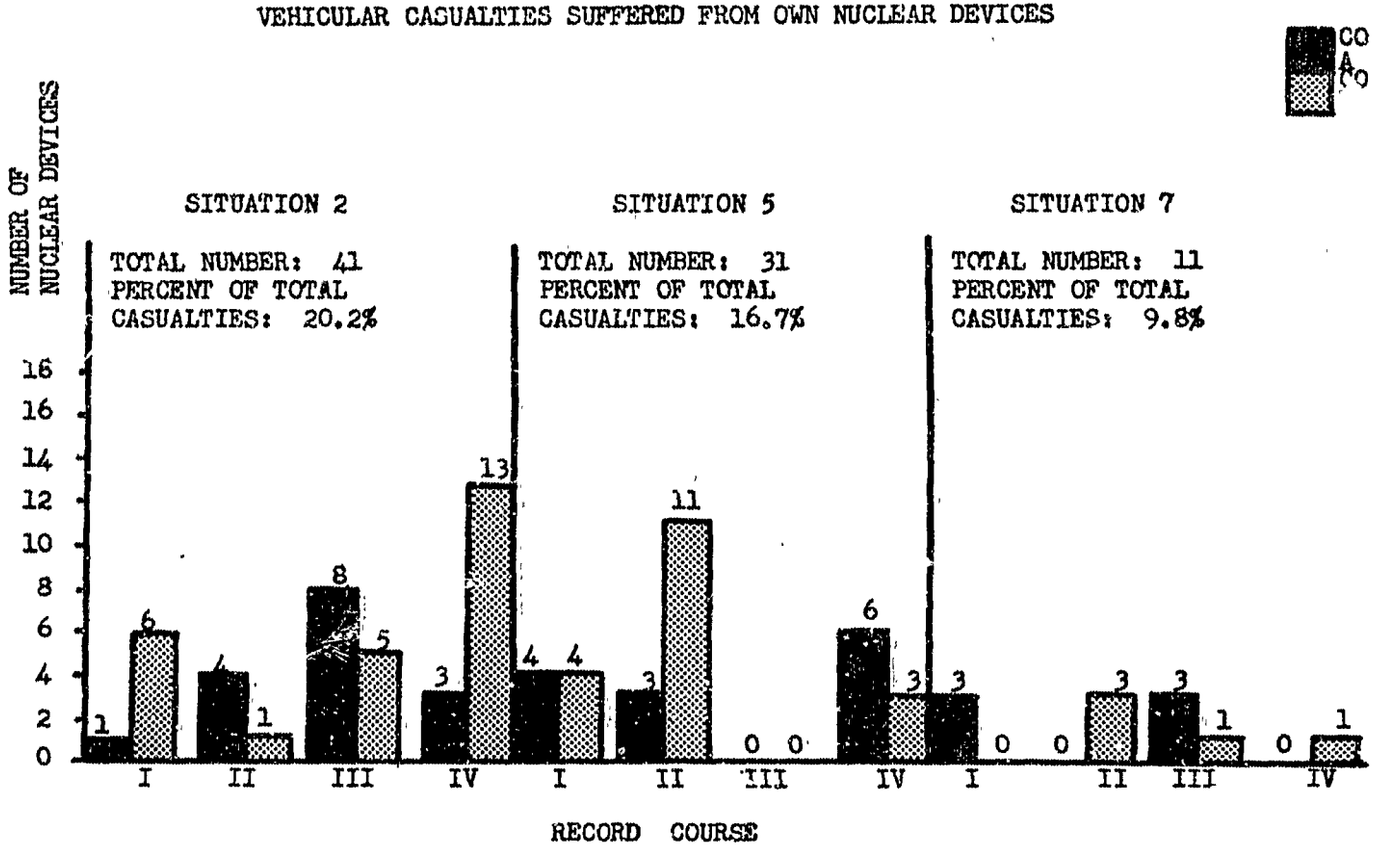


FIGURE 26

SECTION IV

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 1c

27. Statement of Objective:

To determine the capability of the rifle company operating as part of a combat group, to accomplish night offensive missions over extended frontages, using non-nuclear weapons.

28. Indicators:

In the examination of the performance of the PENTANA-type company in night operations available control techniques limited direction of attention to the following areas:

a. Movement rates.

b. Accuracy of movement.

c. Secrecy of movement.

29. Presentation of Data:

a. Movement Rates:

Figure 27 indicates the comparative movement rates of both companies under the different types of illumination.

b. Accuracy of Movement:

Figure 28 indicates the comparative accuracy of movement of both companies under the different types of illumination.

c. Secrecy of Movement:

Figures 29 and 30 indicates the average distances at which elements of both companies were detected by aggressor elements under the different types of illumination.

d. Figure 31 is a tabulation of the infrared equipment employed.

30. Discussion:

a. General:

(1) Control and umpiring techniques and procedures have not yet been perfected to the point that accurate casualty assessment, realistic play of indirect fires or realistic interplay of direct fire elements is possible. Therefore, any attempt to determine success or failure with regard to mission accomplishment in two-sided night engagements was not possible if based on force ratios. For this reason, the Objective 1c was modified in scope in an attempt to determine the best means of illumination from the standpoint of the stated indicators (para 2 above). In fact, even highly accurate position location was exceedingly difficult, and a major portion of the data is based on the best estimates of controllers and observers as to time-position relationship of the company elements during the night situations.

(2) The night situation on the practice course was conducted without illumination and is included in the data and ensuing discussion. Record Course I was conducted with aircraft flares and mortar illuminating shells; Record Course II utilized all combat vehicle headlights; and in Record Course III and IV infrared equipment was used.

(3) Experimentation in night offensive operations included five separate tactical situations over a frontage of 3500-8000 yards. Aggressor action was limited to observation from the objectives. Each of the two experimental companies ran each course. Examination of performance here is

limited to evaluating the comparative effectiveness of the various types of illumination. No significant difference between companies, headquarters, or command ranks could be determined on the basis of this limited sample of observation.

b. Movement Rates:

A comparison of movement rates showed that the combat elements moved at the fastest rate when operating under illumination provided by aircraft flares coupled with route and objective designation illumination provided by artillery and mortar illuminating shells. The use of white light searchlights used for defining objectives and the planned paths thereto supplemented by 5 - 18" tank searchlights on tactical vehicles in the attacking force resulted in a second best rate of movement. The rate of movement of mounted elements equipped with infrared filters on searchlights and vehicles operated by personnel equipped with special infrared viewers gave little advantage to a force over dismounted troops without illumination.

c. Accuracy of Movement:

Data as to accuracy of movement because of limitations as to sequential position location by control personnel at night must be confined to an analysis of ability to reach predesignated locations or objectives. The data from this experiment based solely on linear distance from the stated objective location at situation termination time indicates that mounted troops equipped with infrared devices were best in Record Course 4. It should be noted that in Record Course 3, with identical equipment but with less training in the use of the infrared devices, the experimental companies were less successful than in the practice course with no illumination and where troops were dismounted.

d. Secrecy of Movement:

The analysis of the experimental unit's ability to approach aggressor without detection clearly indicates that the most secret means of movement at night is by foot unencumbered by noisy vehicles. However, mechanized elements with infrared equipment can approach an objective without detection considerably closer than can such elements with other means of illumination.

e. Overall Evaluation of All Indicators:

If sheer speed of movement were the only consideration in night operations, the advantages of white light illumination could have been accurately predicted. However, the experiment appears to have clearly indicated that from the standpoint of accuracy and secrecy the employment of infrared equipment permits an operational capability equivalent to dismounted operations and in addition to providing a slight increase in rate of movement allows the force to have its vehicular mounted weapons and protective armor in the objective area at the time of disclosure.

31. Conclusions:

It was not possible to adequately examine this objective and reach conclusions since control and umpiring techniques and procedures for night operations had not yet been perfected to the point that accurate casualty assessment, realistic play of indirect fires, or realistic interplay of direct fire elements was possible. However, it was determined that the employment of infrared devices promises increases in fighting potential during night operations on a frontage of 3500-8000 yards by permitting vehicular movement to objective areas with accuracy and secrecy approaching that of dismounted actions.

32. Recommendations:

a. That continuing emphasis be accorded the development and standardization of simple power sources and viewing devices in the near infrared field.

b. That increased emphasis be placed on the use of near infrared power sources and viewing devices in the training of United States Army ground forces.

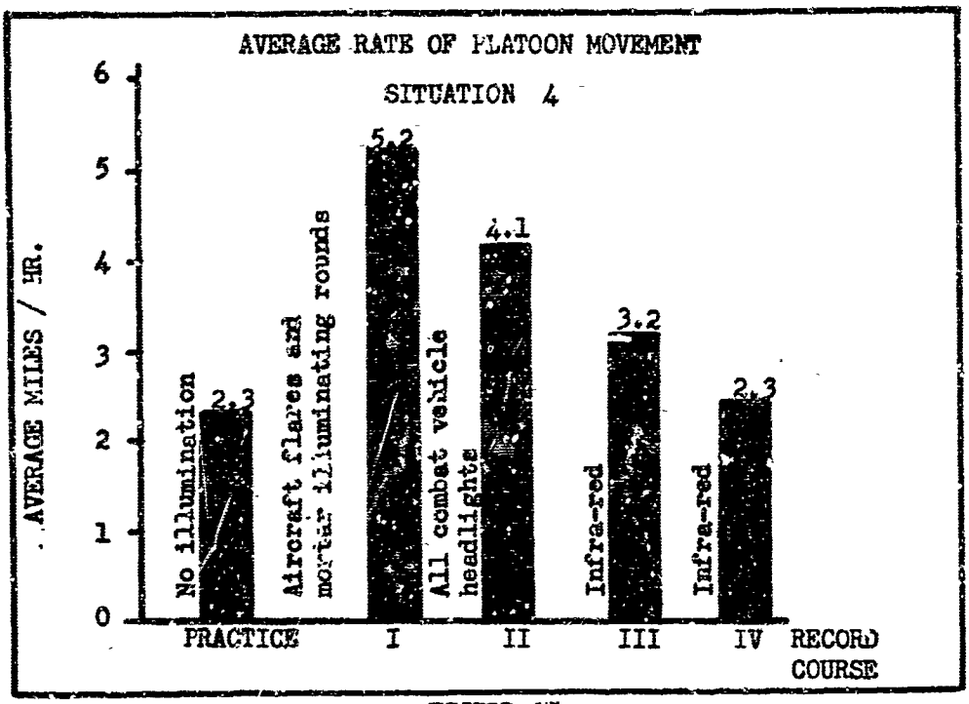


FIGURE 27

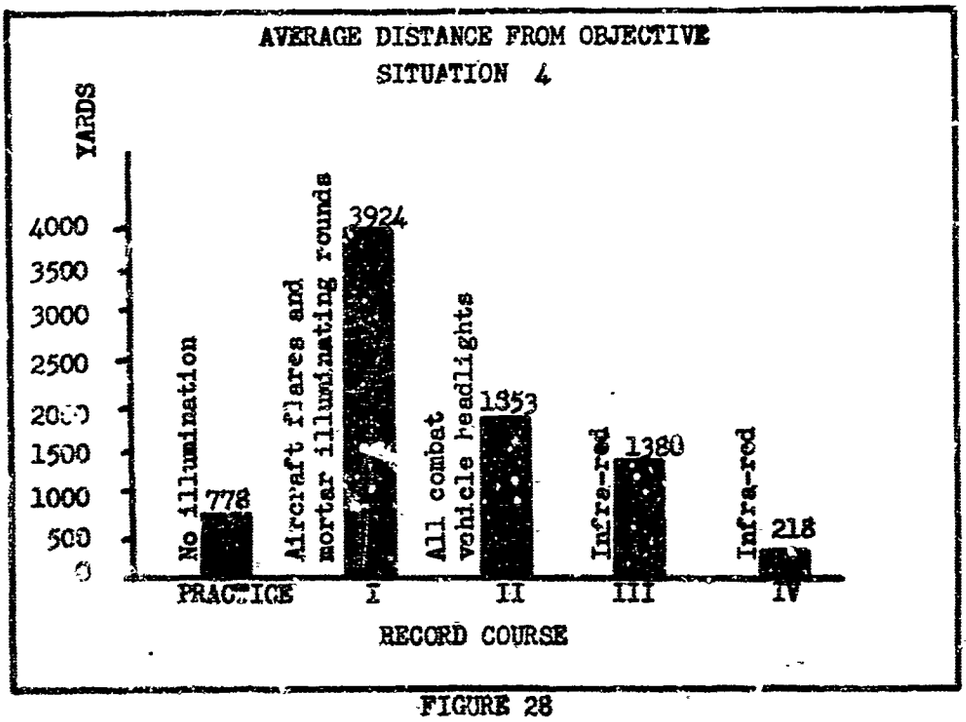


FIGURE 28

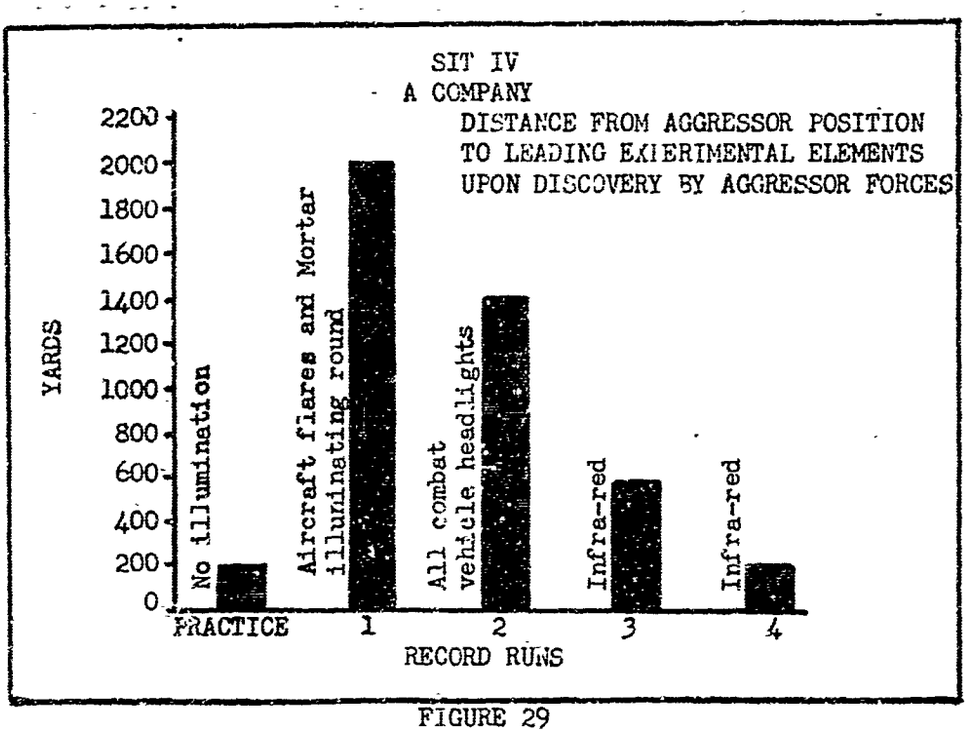


FIGURE 29

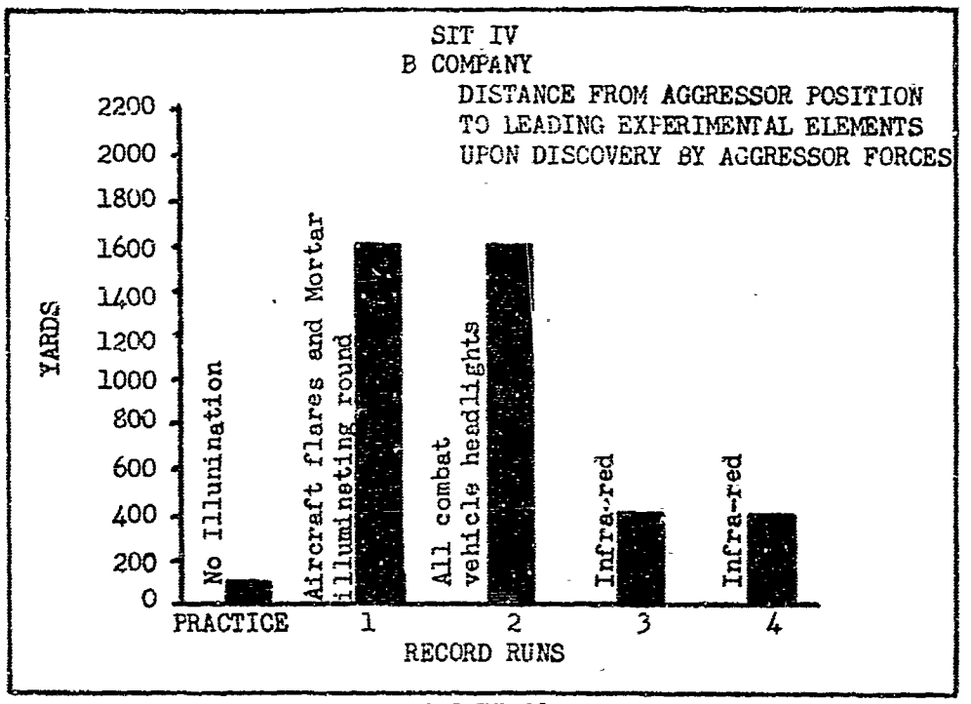


FIGURE 30

TABULATION OF INFRARED EQUIPMENT

ELEMENT	TYPE VEH	NR VEH	FILTER IR	OVM(IR) LIGHT SOURCE	FILTER, IR FIGHTING SL FOR ARMD VEH	IR VIEWERS	18" SL	60" SL
Co Hqs	M59	1		M18(L41) **		T6A*** M19 or M41*		
	¼T	3	1 ea veh			T6A(IR)*		
Inf Plats (4)	M59	5		M18(L41) **		T6A*** M19 or M41*		
AT Plat	M59	4		** M18(L41)		T6A*** M19 or M41*		
	¼T	1	1 ea veh			T6A*		
Tk Plat	M48	5			1 ea Tk	T6A***	1 ea Tk	
SL Sec	2½ w/tr	2						2

* 1 ea driver
** 1 ea vehicle
*** 1 ea vehicle commander

Figure 31

CONFIDENTIAL—MODIFIED HANDLING AUTHORIZED

SECTION V

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 2

33. Statement of Objective:

To determine the effect of several types of rifle company headquarters on the capability of the company to accomplish the offensive and defensive missions.

34. Indicators:

The areas listed below were used in comparing the two headquarters organizations. Comparisons were made for each record course and like situations.

a. Planning time.

b. Ordering time.

c. Movement time.

d. Mission time.

e. Frequency of mission accomplishment.

f. Frequency of mission accomplishment with respect to span of control.

g. Percentages of vehicle casualties inflicted to casualties sustained.

h. Ratio of vehicle casualties inflicted to casualties sustained.

i. Friendly casualties from own nuclear devices.

j. Results obtained in use of nuclear devices.

35. Presentation of Data:

a. Planning Time:

A graphical presentation of the average planning time required for the Headquarters 1 and Headquarters 2 Organizations for each record course and like situations is shown in Figures 32 and 33.

b. Ordering Time:

A graphical presentation of the average time required to issue an operations order for the Headquarters 1 and Headquarters 2 Organizations for each record course and like situations is shown in Figures 34 and 35.

c. Movement Time:

Average movement times (the time required from beginning of movement of the first unit to a defensive position or point of contact -- not necessarily the same unit) for Headquarters 1 and Headquarters 2 Organizations are shown in Figures 36 and 37.

d. Mission Time:

Average time utilized by both Headquarters 1 and Headquarters 2 Organizations upon receipt of the order to the end of a situation for all situations and all successful situations is shown in Figures 38 and 39.

e. Frequency of Mission Accomplishment:

Frequency of accomplishment of defensive and offensive missions for both Headquarters 1 and Headquarters 2 Organizations in the four record courses are shown in Figure 40.

f. Frequency of Mission Accomplishment with Respect to Span of Control:

Frequency of mission accomplishment of each headquarters with respect to span of control is shown in Figure 41.

g. Percentage of Vehicle Casualties Inflicted and Sustained:

A graphical presentation of vehicular casualties inflicted and sustained in percentages comparing Headquarters 1 and Headquarters 2 Organizations for each record course is shown in Figure 42.

h. Ratio of Vehicle Casualties Inflicted to Casualties Sustained:

A tabular presentation of the ratio of vehicular casualties inflicted and sustained by both Headquarters 1 and Headquarters 2 Organizations for each record course is shown in Figure 43.

i. Friendly Casualties from Own Nuclear Devices:

A graphical portrayal of cost in casualties sustained by both Headquarters 1 and Headquarters 2 Organizations from own nuclear devices is shown in Figure 44.

j. Results Obtained in Use of Nuclear Devices:

Figures 45 and 46 provide the average number of nuclear devices used and average number of vehicular casualties produced in each record course and like situations comparing Headquarters 1 and Headquarters 2 Organizations.

k. Summary:

A summary of comparisons of these indicators is reflected in Figure 47.

36. Discussion:

a. General:

Normal difficulties inherent to the experimental investigation of an objective of this nature were compounded by the following considerations which, though unavoidable in the face of competing requirements, occasioned an inadequate environment for exhaustive comparison of the candidate headquarters:

(1) Limited time on the one hand and the number of repetitions necessary for the statistical analysis of this and other objectives on the other, precluded extending the duration of any experimental run to the point where fatigue would have its logical impact on the two headquarters under consideration.

(2) The necessity for constant measurement of the capabilities of the commanders in answering the objective relating to command ranks precluded the assessment of company commanders as casualties, another realistic factor which would logically have a different bearing on the two headquarters under consideration.

The averages that appear in the following discussion are all based on daylight missions, offensive and defensive, unless otherwise noted. Associated with each average difference is a statistical error term which must be taken into consideration before making any conclusions.

In addition, military observations concerning quality of plans and orders and quality of performance of actions, regardless of time or casualty considerations, were weighed in evaluating this objective. Careful analysis of these military observations within the limitations of the experiment revealed no significant average difference between the candidate headquarters.

In Headquarters 2 the operations and reconnaissance officer was used primarily for planning, reconnaissance and preparation of the unit operations order. Occasionally he was employed as a task force commander. The additional enlisted personnel performed assigned duties as reconnaissance sergeant, vehicle drivers, and radio-telephone operators.

b. Planning Time:

The average planning time for the four record courses favors the Headquarters 1 Organization by one minute and fifty-six seconds. Statistically this difference is not significant. However, in considering the planning times for offensive actions only, the Headquarters 1 Organization required 6 minutes less than Headquarters 2. This is statistically a significant difference.

c. Ordering Time:

The Headquarters 2 Organization more frequently required less time to issue orders than did the Headquarters 1 Organization. However, the overall average difference in ordering times is small compared with the error of plus or minus 8 minutes and hence there is no significant difference between headquarters.

d. Movement Time:

The Headquarters 2 Organization more frequently required less time to initiate movement once the order was issued than did the Headquarters 1 Organization. This advantage was maintained in three of the four record courses. The average time favors the Headquarters 2 Organization by two minutes with an error associated of plus or minus 8 minutes. As with the ordering time, the difference in averages is small compared with the possible error; and thus, with respect to these criteria, the headquarters are not significantly different.

e. Mission Time:

Those situations where both Headquarters 1 and Headquarters 2 Organizations were equally successful, the Headquarters 2 Organization required less time to accomplish the mission than did the Headquarters 1 Organization. This advantage was maintained in all four situations used. Situations 1 and 3 cannot be used as a like number of missions were not accomplished. The average mission time favors the Headquarters 2 Organization by twelve minutes per situation. Headquarters 2 took significantly less time in accomplishing its defensive missions but these were actions where time was controlled by the aggressor. No significance can be attached to the differences between the two headquarters in accomplishing offensive missions.

f. Frequency of Mission Accomplishment:

When comparing the number of mission accomplishments by type headquarters, the Headquarters 1 Organization accomplished 75% of the 12 offensive missions and 58% of 12 defensive missions. The Headquarters 2 Organization accomplished 33% of the 12 offensive missions and 58% of the 12 defensive missions. These percentages have an error of plus or minus 15 - 20%. On these basis of analysis, Headquarters 1 is significantly better on the offensive.

g. Frequency of Mission Accomplishment with Respect to Span of Control:

When comparing mission accomplishment with respect to span of control, the Headquarters 1 Organization accomplished four of four offensive missions (100%) and one of four defensive missions (25%) at the 2500-3500 yard span, and the Headquarters 2 Organization accomplished three of four offensive missions (75%) and one of four defensive missions (25%). The Headquarters 1 Organization accomplished four of four offensive missions (100%) and three of four defensive missions (75%) at the 3500-8000 yard span, and the Headquarters 2 Organization accomplished zero of four offensive missions (0%) and three of four offensive missions (75%). The Headquarters 1 Organization accomplished one of four offensive missions (25%) and three of four defensive missions (75%) at the 8000-12000 yard span, and the Headquarters 2 Organization accomplished one of four offensive missions (25%) and three of four defensive missions (75%). Headquarters 1 is significantly superior in the 3500-8000 yard span.

h. Percentage of Vehicle Casualties Inflicted to Casualties Sustained:

The percentage of vehicle casualties inflicted to casualties sustained favors the Headquarters 1 Organization. This advantage was maintained in three of the four record courses. The Headquarters 1 Organization inflicted an average of 58.1% vehicle casualties and sustained an average of 38.1% vehicle casualties per situation for the four record courses. The Headquarters 2 Organization inflicted an average of 54.8% vehicle casualties and sustained an average of 42.6% per situation for the four record courses. In this respect Headquarters 1 is significantly better in offensive situations with regard to casualties inflicted.

i. Ratio of Vehicle Casualties to Casualties Sustained:

When comparing the ratio of average percentage of vehicle casualties inflicted to average percentage of vehicle casualties sustained the Headquarters 1 Organization has a ratio of 1.51 to 1. The Headquarters 2 Organization has a ratio of 1.29 to 1. Here Headquarters 1 is significantly better in offensive actions.

j. Friendly Casualties from Own Nuclear Devices:

The Headquarters 1 Organization suffered less casualties from own nuclear devices than did Headquarters 2. The Headquarters 1 Organization suffered 16.5 casualties per record course from own nuclear fires compared to 27.2 for Headquarters 2. This difference is not considered significant.

k. Results Obtained in Use of Nuclear Devices:

The Headquarters 1 Organization used a total of 160 devices for the four record courses, inflicting 341 vehicle casualties for an average of 2.16 vehicles per nuclear fire. The Headquarters 2 Organization used a total of 207 nuclear devices for the four record courses, inflicting 374 vehicle casualties for an average of 1.80 vehicles per nuclear fire.

l. Summary:

(1) The Headquarters 1 used an average of 6 minutes less time to plan an offensive mission than did the Headquarters 2. The Headquarters 1 Organization accomplished the offensive mission 75% of the time as compared to only 33% for the Headquarters 2. At the middle span of control (3500-8000 yards) the Headquarters 1 accomplished the mission 87.5% as compared to 37.5% for the Headquarters 2. Thus, of all measures considered comparing headquarters, there are only five showing significant differences.

(2) The great variance reflected between Headquarters 1 and Headquarters 2 in successfully completed missions is probably directly related to the aggressiveness and initiative of individual unit commanders during the conduct of each mission since such traits would generally influence the action more during an offensive operation.

(3) Limitations in the existing data do not indicate which type headquarters could operate over a prolonged period of time without serious breakdown in control of its unit. The time span for each record course was approximately 36 hours and was not sufficient to permit a comparison.

The Headquarters 2 Organization as organized would enable the Company Commander to use the Operations and Reconnaissance Officer as a relief in commanding the unit thereby remaining mentally and physically capable over a prolonged period. The Headquarters 1 Organization as organized does not provide the Company Commander with any relief and in mobile type operations the Company Executive Officer would be fully engaged in the administration of the unit.

37. Conclusions:

The results of this experiment do not provide a large and consistent difference in performance on which to base an augmentation of the current company headquarters structure by the addition of reconnaissance and operations personnel. However, the limited time permitted for experimentation and competing requirements of other objectives did not permit an exhaustive examination of the candidates.

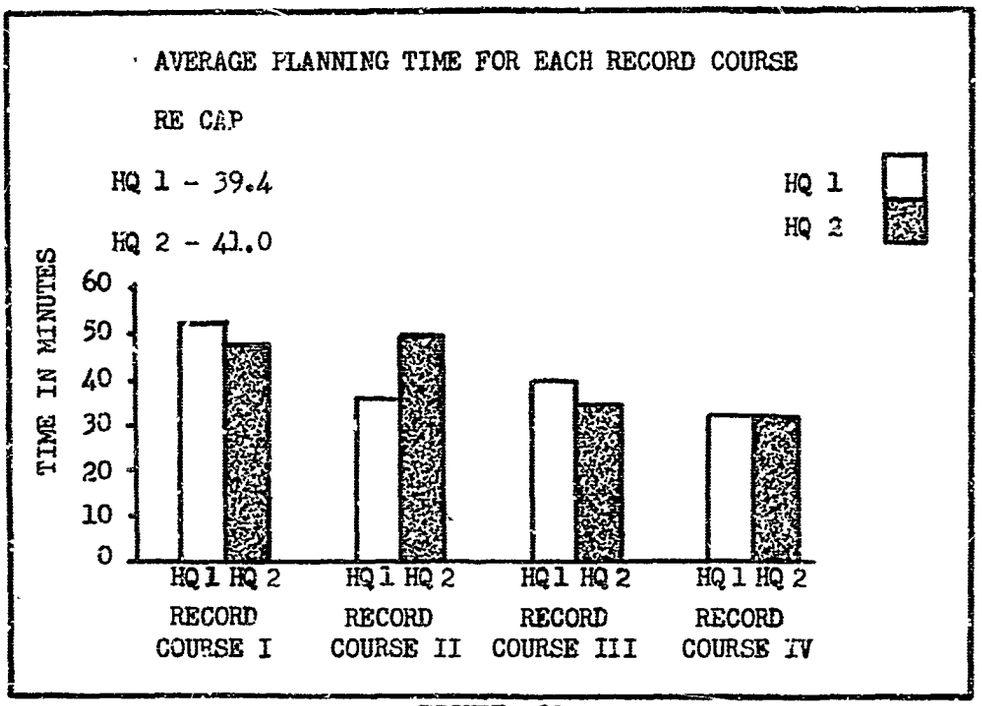


FIGURE 32

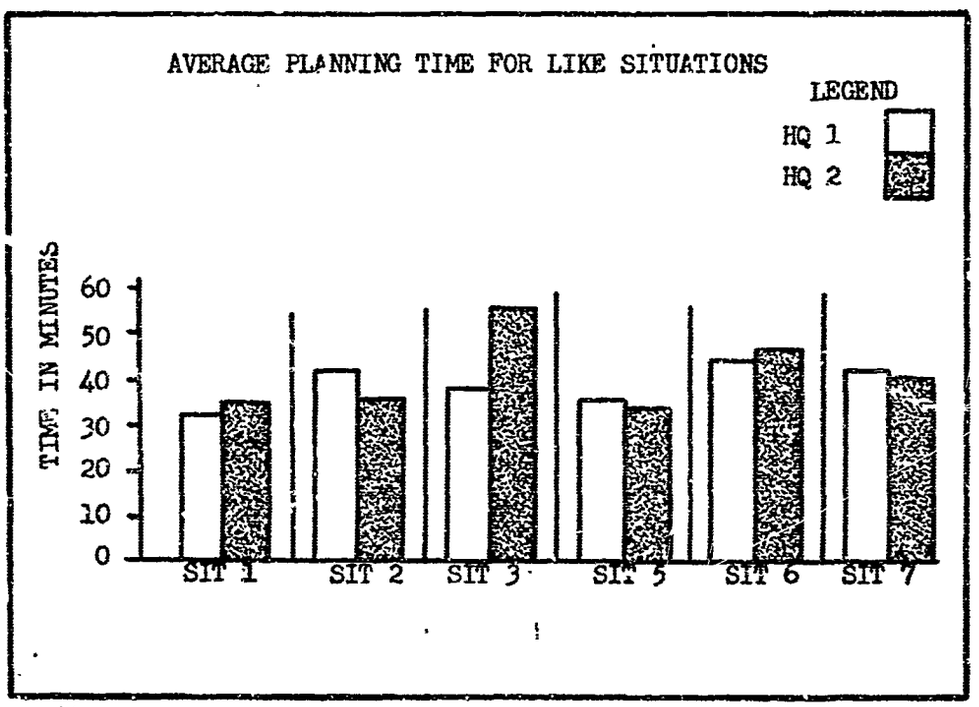


FIGURE 33

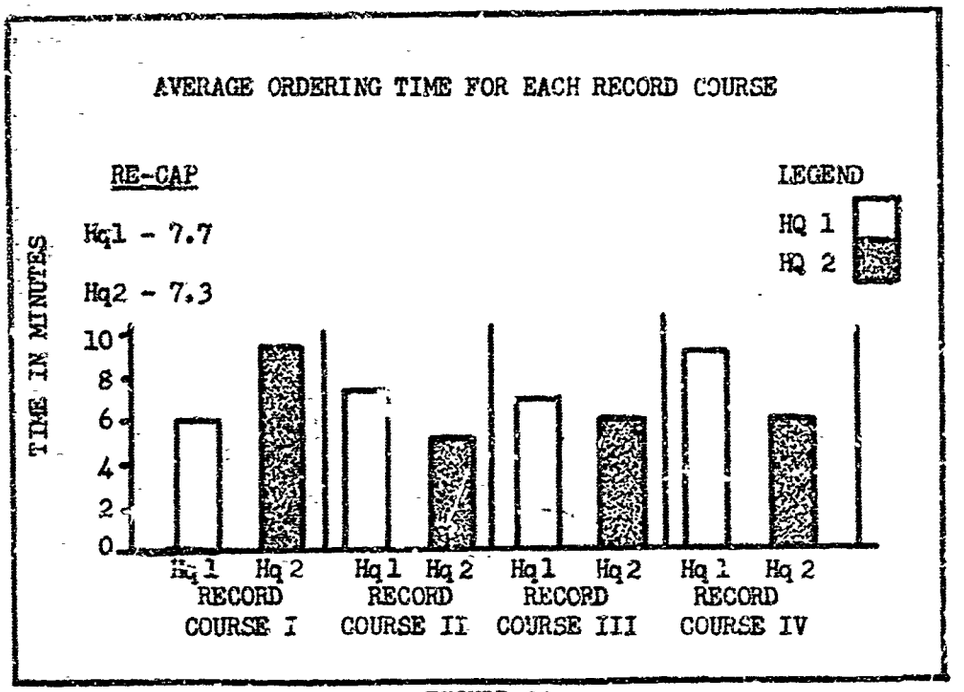


FIGURE 34

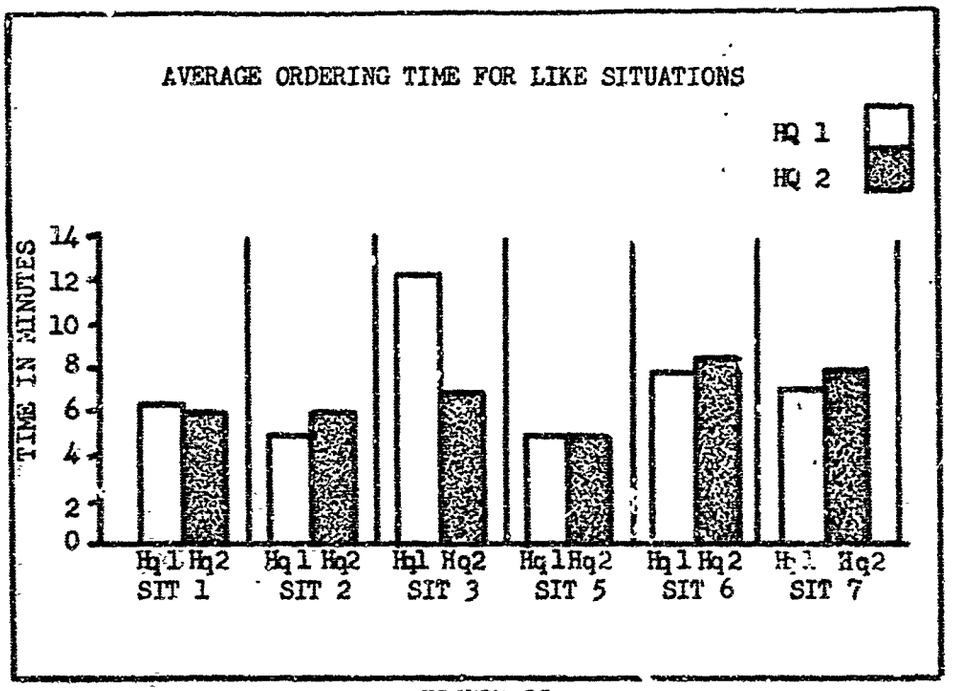


FIGURE 35

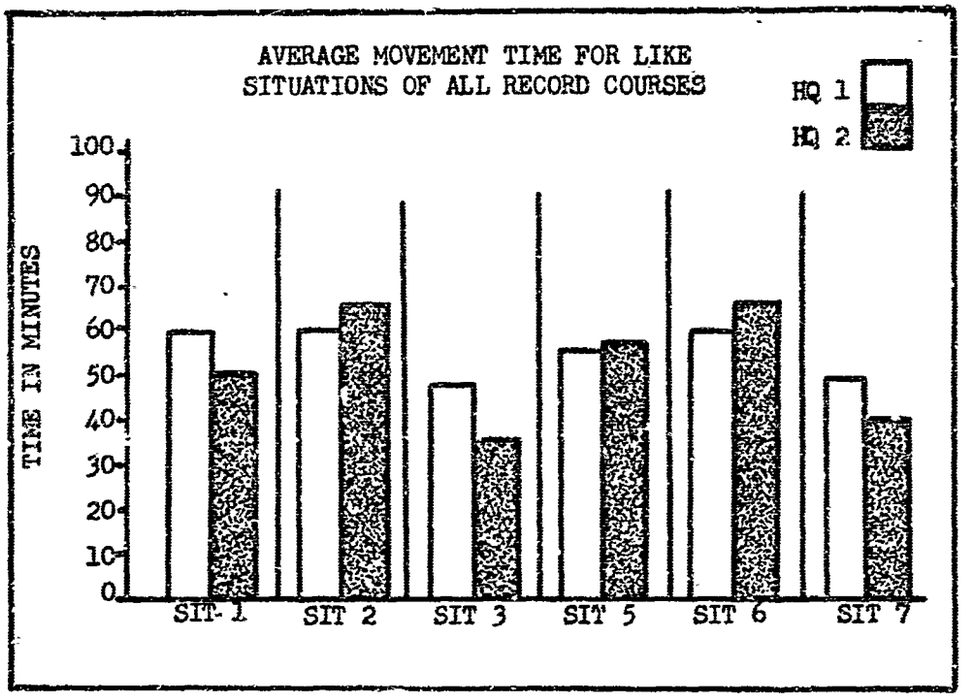


FIGURE 36

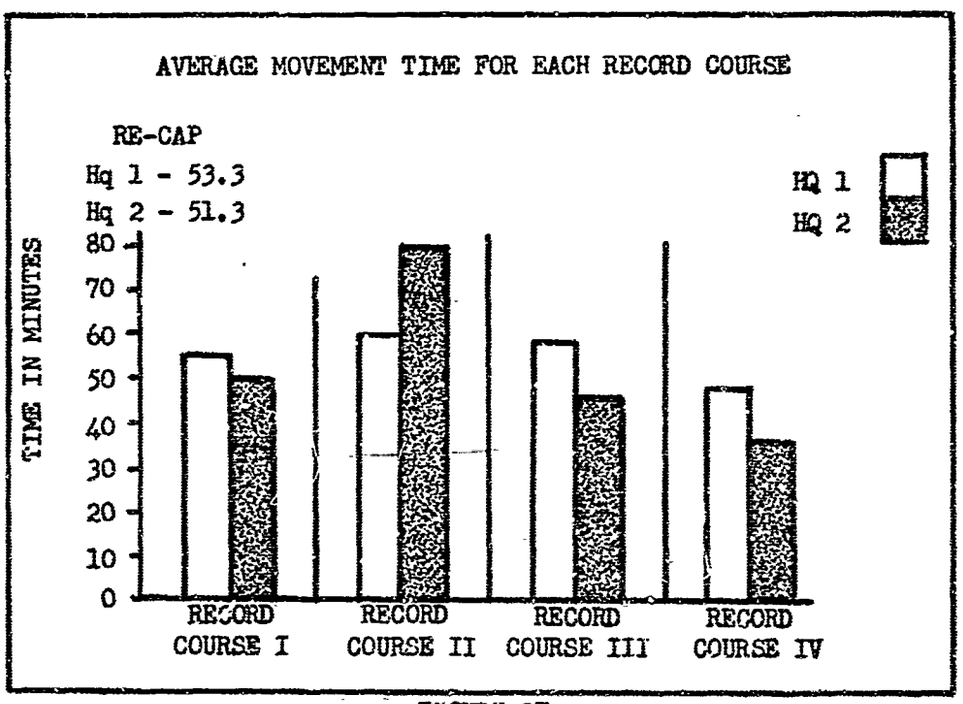


FIGURE 37

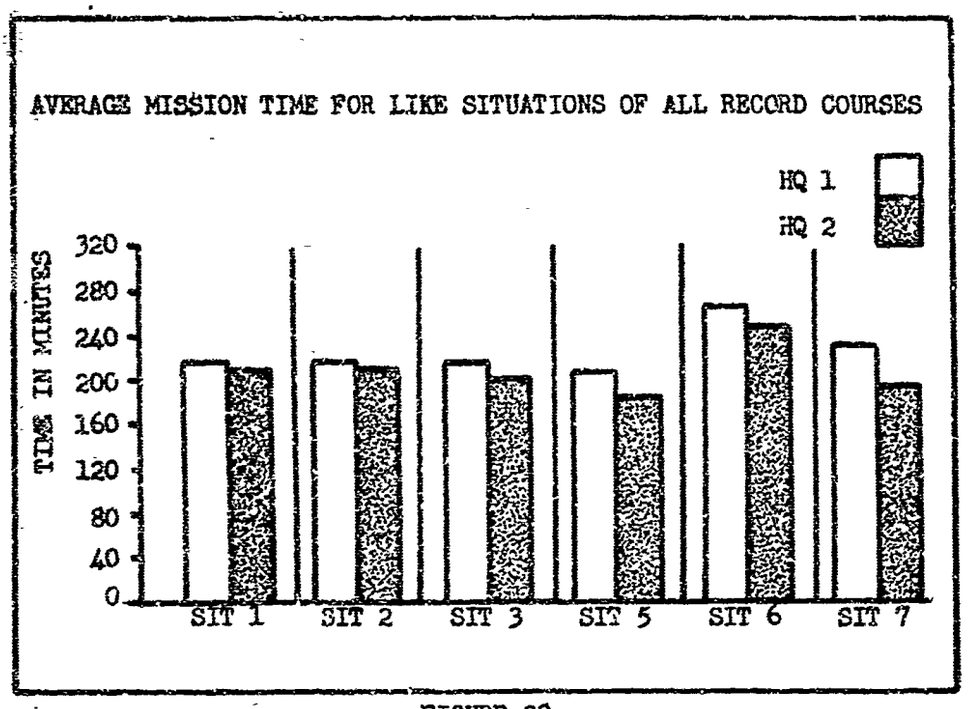


FIGURE 38

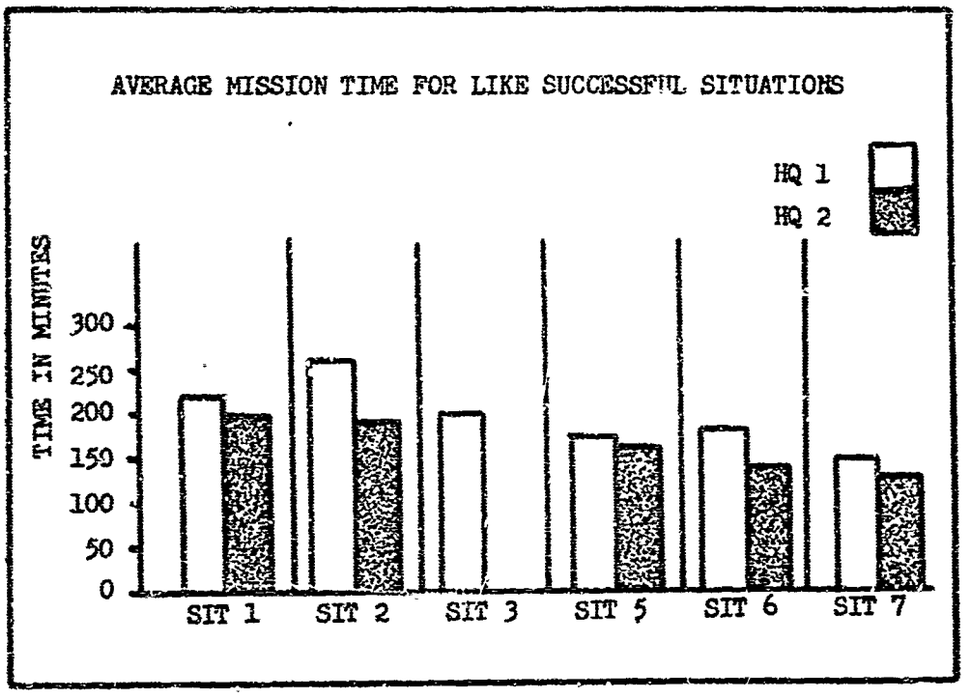


FIGURE 39

FREQUENCY OF MISSION ACCOMPLISHMENT BY HQ 1 AND HQ 2

HQ 1	-	Accomplished 9 Offensive Missions	75%
		Accomplished 7 Defensive Missions	58%
HQ 2	-	Accomplished 4 Offensive Missions	33%
		Accomplished 7 Defensive Missions	58%

Total Offensive Missions 4 Record Runs 24 Missions

Total Defensive Missions 4 Record Runs 24 Missions

Figure 40

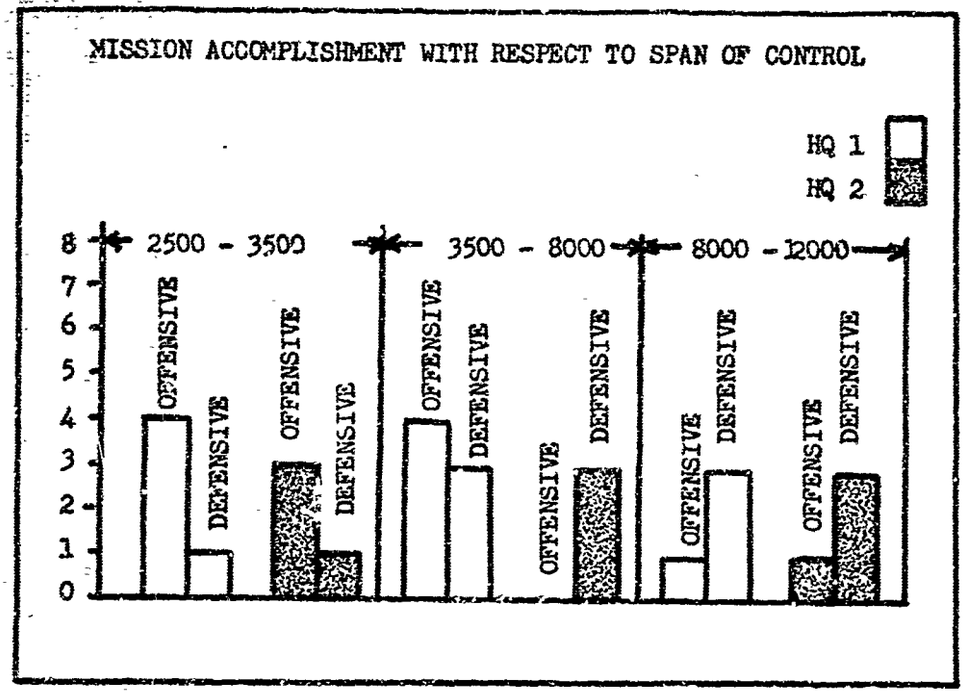
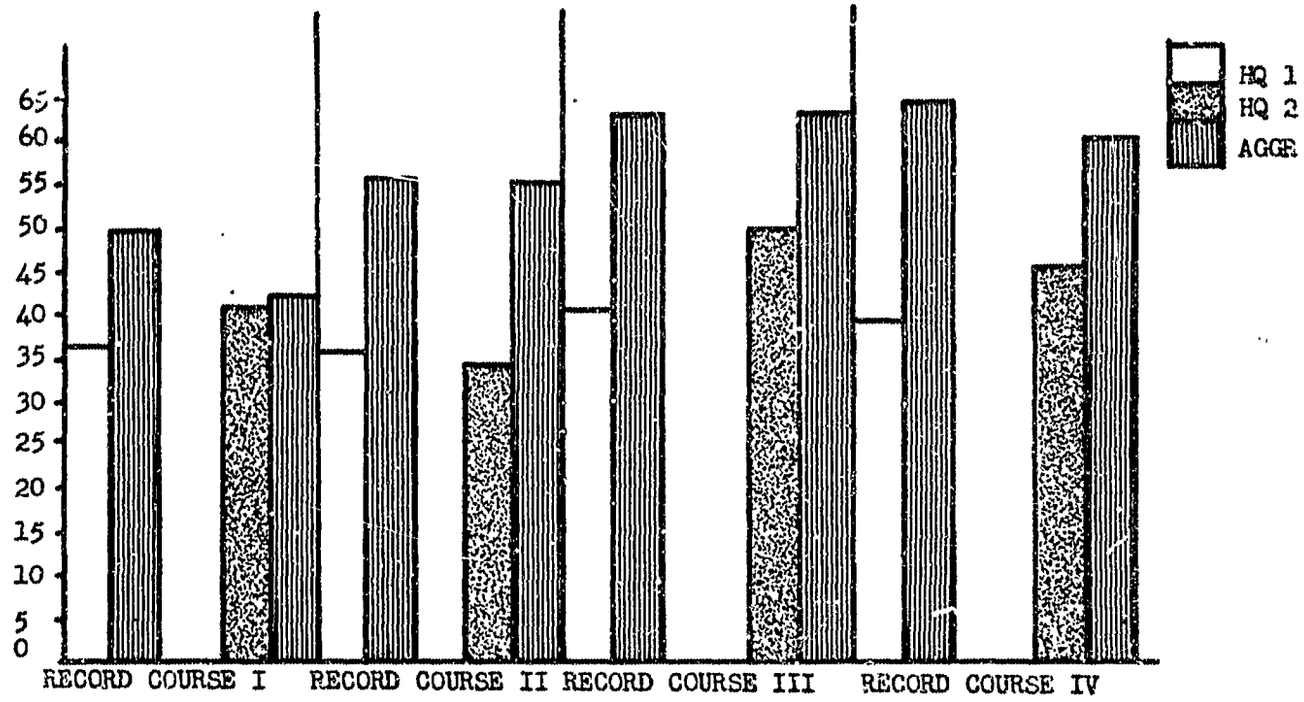

MISSION ACCOMPLISHMENT WITH RESPECT TO SPAN OF CONTROL
HQ 1
HQ 2
8
7
6
5
4
3
2
1
0
2500 - 3500
3500 - 8000
8000 - 12000
OFFENSIVE
DEFENSIVE
OFFENSIVE
DEFENSIVE
OFFENSIVE
DEFENSIVE
OFFENSIVE
DEFENSIVE
OFFENSIVE
DEFENSIVE
OFFENSIVE
DEFENSIVE

FIGURE 41

AVERAGE PERCENTAGE OF VEHICLE CASUALTIES INFLICTED
AND SUSTAINED PER SITUATION FOR EACH RECORD COURSE



RATIO OF VEHICLE CASUALTIES INFLICTED AND SUSTAINED FOR EACH RECORD COURSE

	RC I	RC II	RC III	RC IV
HQ 1	1.36:1	1.56:1	1.55:1	1.63:1
HQ 2	.99:1	1.61:1	1.27:1	1.33:1

FIGURE 42

CONFIDENTIAL—MODIFIED HANDLING AUTHORIZED

RATIO OF VEHICULAR CASUALTIES INFLICTED
TO CASUALTIES SUSTAINED

AVERAGES OF ALL SITUATIONS

SITUATION 1

0.68 to 1

SITUATION 2

1.21 to 1

SITUATION 3

0.90 to 1

SITUATION 5

1.41 to 1

SITUATION 6

0.56 to 1

SITUATION 7

1.98 to 1

Figure 43

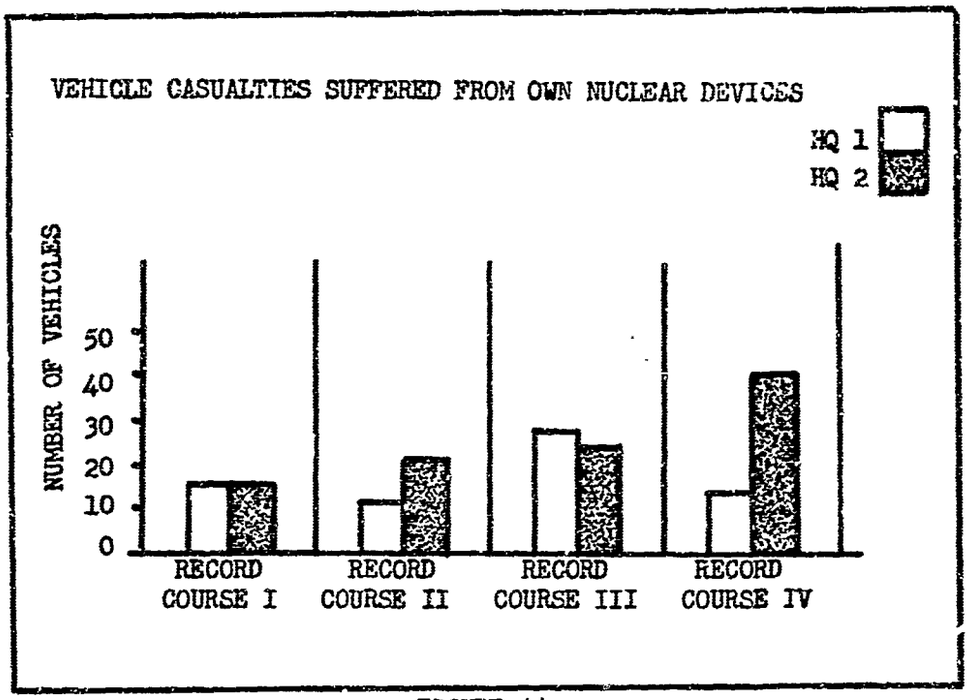


FIGURE 44

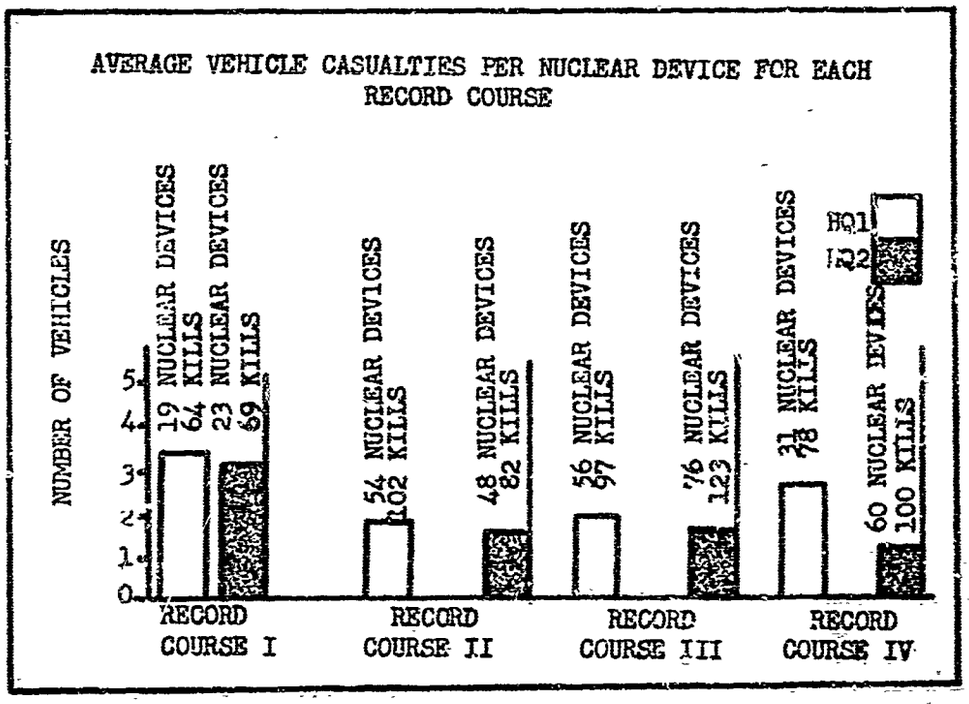


FIGURE 45

AVERAGE VEHICLE CASUALTIES PER NUCLEAR DEVICE FOR COMBINED LIKE SITUATIONS

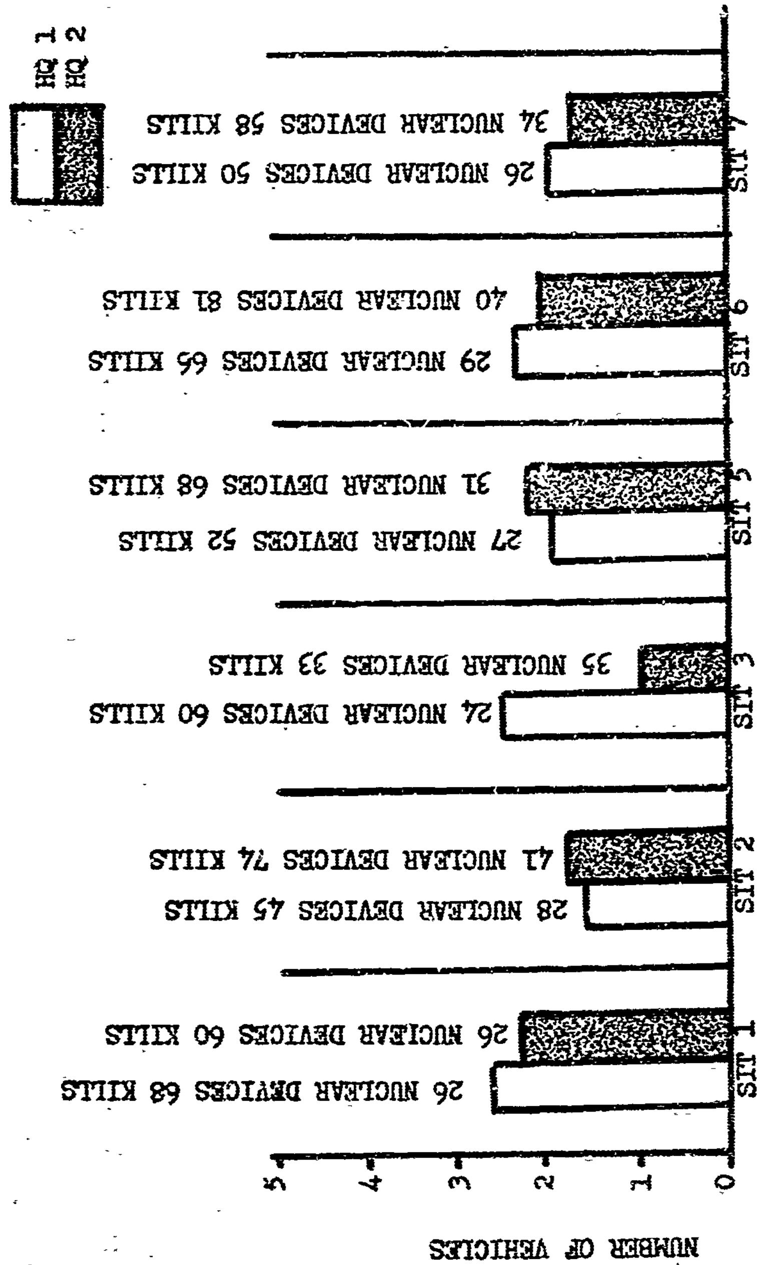


FIGURE 46

SUMMARY OF COMPARISONS OF INDICATORS

INDICATOR	RESULTS
Planning Time	The Headquarters 1 organization required an average planning time of 39.4 minutes for the four record courses as compared to 41.0 for Headquarters 2.
Ordering Time	The Headquarters 2 organization required an average ordering time of 7.3 minutes for the four record courses as compared to 7.7 minutes for Headquarters 1.
Movement Time	The Headquarters 2 organization required an average movement time of 51.3 minutes for the four record courses as compared to 53.3 minutes for Headquarters 1.
Mission Time	Only situations where both headquarters were successful could be used; of the four situations used the Headquarters 2 required 12 minutes less per situation than the Headquarters 1.
Frequency of Mission Accomplishment	Headquarters 1 accomplished 9 of 12 offensive missions . . . . . 75% Accomplished 7 of 12 defensive missions . . . . . 58% Headquarters 2 accomplished 4 of 12 offensive missions . . . . . 33% Accomplished 7 of 12 defensive missions 58%
	2500-3500 yard span
Frequency of Mission Accomplishment with Respect to Span of Control	Headquarters 1 accomplished 4 of 4 offensive missions . . . . . 100% Accomplished 1 of 4 defensive missions 25%

Figure 47

INDICATOR	RESULTS
	Headquarters 2 accomplished 3 of 4 offensive missions 75%
	Accomplished 1 of 4 defensive missions 25%
	3500-8000 yard span
	Headquarters 1 accomplished 4 of 4 offensive missions 100%
	Accomplished 3 of 4 defensive missions 75%
	Headquarters 2 accomplished 0 of 4 offensive missions 0%
	Accomplished 3 of 4 defensive missions 75%
	8000-12000 yard span
	Headquarters 1 accomplished 1 of 4 offensive missions 25%
	Accomplished 3 of 4 defensive missions 75%
	Headquarters 2 accomplished 1 of 4 offensive missions 25%
	Accomplished 3 of 4 defensive missions 75%
Percentage of Vehicle Casualties Inflicted to Casualties Sustained	The Headquarters 1 organization inflicted an average of 58.1 vehicle casualties and sustained 38.1 vehicle casualties per record course. The Headquarters 2 organization inflicted 54.8 vehicle casualties and sustained 42.6 vehicle casualties per record course.

Figure 47 (continued)

INDICATOR	RESULTS
Ratio of Vehicle Casualties Inflicted to Casualties Sustained	When comparing ratio of vehicle casualties inflicted to casualties sustained the Headquarters 1 organization has a ratio of 1.51 to 1. The Headquarters 2 organization has a ratio of 1.29 to 1.
Friendly Casualties from Own Nuclear Devices	The Headquarters 1 organization suffered 16.5 casualties per record course from own nuclear devices as compared to 27.2 for Headquarters 2.
Results Obtained in Use of Nuclear Devices	The Headquarters 1 organization inflicted an average of 2.16 vehicle casualties per nuclear device as compared to 1.80 for Headquarters 2.

Figure 47 (continued)

SECTION VI

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 3

38. Statement of Objective:

To determine the effect on the capability of several types of rifle company headquarters to command and control the company in light of attachment of additional subordinate elements and the availability of helicopters for airlift of combat elements.

39. Indicators:

In examining this objective, attention has been directed to the following factors:

a. Planning time.

b. Ordering time.

c. Movement time.

d. Mission time.

e. Missions accomplished with respect to the number of attachments and spans of operations.

40. Presentation of Data:

a. Planning Time:

Figure 48 is a tabulation of the planning times used by each headquarters in all situations. Figure 49 is planning

times for each headquarters averaged over four record courses presented by offensive situations, defensive situations and spans of operations.

b. Ordering Time:

Figure 50 is a tabulation of the ordering times used by each headquarters in all situations. Figure 51 is ordering times for each headquarters averaged over four record courses presented by offensive situations, defensive situations and spans of operations.

c. Movement Time:

Figure 52 is a tabulation of the movement times resulting from orders by each headquarters in all situations. Figure 53 shows the movement times required by each headquarters, averaged over four record courses presented by offensive situations, defensive situations and spans of operations.

d. Mission Time:

Figure 54 indicates those missions successfully accomplished by both type headquarters and the mission time involved. Figures 55 and 56 present the time required to accomplish those missions which were successfully accompl shed by each headquarters by situation and an average of the time used by each headquarters for all like successful situations.

e. Miss ns Accomplished with Resp t to Number of Attachments and Spans of Operations:

Figures 57 and 58 portray the number of successfully accomplished situations by each type headquarters, and the number of successful missions by both type headquarters at each span of operations. Figure 59 reflects successfully accomplished missions by type headquarters for offensive and defensive situations.

f. A summary of comparisons of indicators is attached as Figure 60.

41. Discussion:

a. Planning Time:

Analysis indicates that in planning for offensive operations, the addition of attachments and the simultaneous

e. Missions Accomplished with Respect to the Number of Attachments and Spans of Operations:

Headquarters 1 was more successful than Headquarters 2 in accomplishing its offensive missions under conditions involving no attachments in the 2500-3500 yard span of operations and with an ATGM section and tank platoon attached, and helicopters made available for use in the 3500-8000 yard span of operations. Both headquarters were equally ineffective in accomplishing offensive missions in the 8000-12000 yard span of operations. In accomplishment of defensive missions both headquarters were identical at all spans with all attachments. There appears to be an overall indication that the effect of attachments and availability of helicopters was more effective in preserving the offensive capability of Headquarters 1 than Headquarters 2 as the span of operations increased. The great variance reflected between Headquarters 1 and Headquarters 2 in successfully completed offensive missions is probably directly related to the aggressiveness and initiative of individual unit commanders during the conduct of each mission, since such traits would generally influence the action more during an offensive operation. Observations by military observers during the experimentation revealed no appreciable increased workload by unit commanders and their subordinates and the existing communications system as a result of attachments. There is insufficient evidence to determine the affect or impact on either headquarters of the attachment of units by type, since the tank platoon and ATGM section were attached and helicopters made available simultaneously at the beginning of Situation Nr 3 and the direct support artillery platoon and 5th rifle platoon were attached simultaneously at the beginning of Situation Nr 6.

f. Effects of Use of Helicopters on Command and Control:

Helicopters were utilized in Situation Nr 3 of all courses to provide a means of rapidly moving combat elements about the battle area. Maintenance of communication with elements in flight was a major control problem experienced by use of this means of transport. No other complications to command and control capabilities resulted.

42. Conclusion:

There was no significant effect on the capability of the several types of rifle company headquarters to command and control the company in light of attachment of ground elements or the availability of helicopters for lift of combat elements.

increase in span of operations occasioned increases in time requirements and appeared to have a greater impact on Headquarters 2 than Headquarters 1. In planning for defensive operations, no significant increase in planning time is evident until the second set of elements were attached. Analysis of average planning times by span of operations for both defensive and offensive operations indicates that increases in attachments or spans of operations had no significantly different effect on the planning time required by either headquarters.

b. Ordering Time:

Analysis indicates that in ordering time for offensive operations the addition of attachments and the simultaneous increase in span of operations occasioned increases in time requirements and appeared to have a greater impact on Headquarters 2 than Headquarters 1. In ordering times required for defensive operations no significant increase in ordering time is evident until the second set of elements were attached. Analysis of average ordering time by span of operations for both defensive and offensive operations indicates that increases in attachments on span of operations had no significantly different effect on the ordering time required by either headquarters.

c. Movement Time:

Analysis indicated that there was no significantly different effect on the time required for movement to contact by the companies when commanded by the differing headquarters occasioned by increased attachments or span of control.

d. Mission Time:

Although a total of 48 missions were run by the two type headquarters, only 27 were considered to be effectively accomplished. Those not considered to be effectively accomplished were situations in which certain actions were not completed by the hour of darkness, specific actions were not accomplished in time to prevent the inflicting of excessive casualties to the experimental company or the experimental company had already sustained casualties such as to render it ineffective. Headquarters 2 required on an average less time to accomplish its mission in all instances where it was successful than did Headquarters 1.

43. Recommendation:

That in the study, development, and experimentation with proposed platoon and company level elements the traditional limitation of five subordinate elements be discarded in favor of an increase to between 6 to 10 to effect more economical utilization of control capabilities at this level.

PLANNING TIME USED - ALL SITUATIONS

	RECORD COURSE I		RECORD COURSE II	
	Co A Hq 2	Co B Hq 1	Co A Hq 1	Co B Hq 2
Situation 1	39 min	36 min	27 min	37 min
2	41	68	34	37
3	58	49	38	54
5	35	49	28	47
6	63	54	42	65
7	44	57	38	61

	RECORD COURSE III		RECORD COURSE IV	
	Co A Hq 2	Co B Hq 1	Co A Hq 1	Co B Hq 2
Situation 1	38 min	37 min	31 min	29 min
2	31	36	32	33
3	35	30	37	53
5	35	35	30	24
6	38	58	33	29
7	34	39	28	23

Figure 48

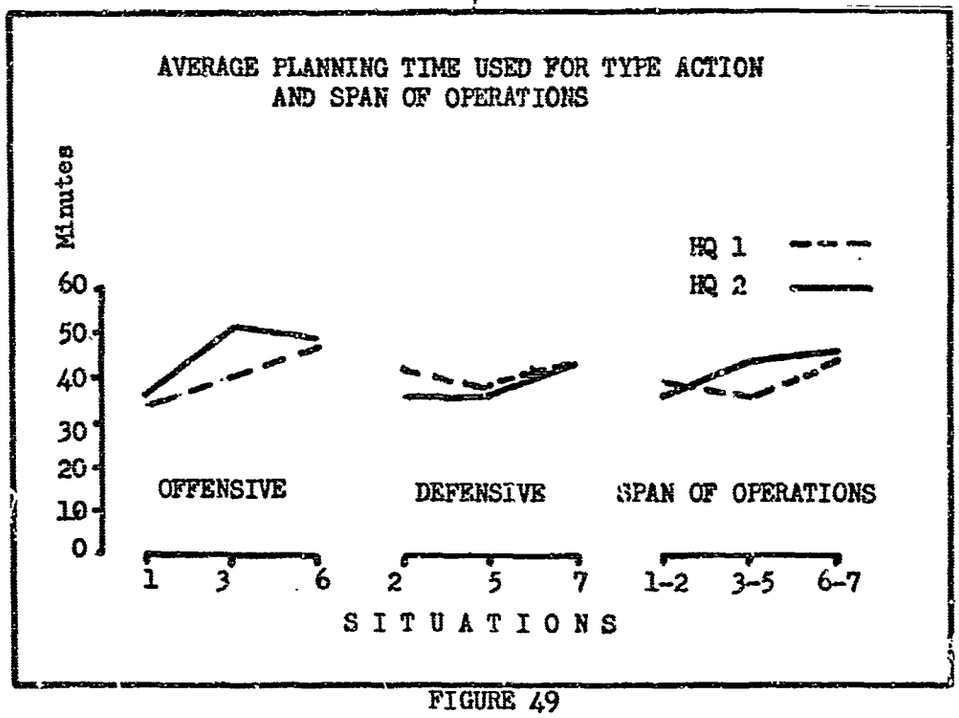

AVERAGE PLANNING TIME USED FOR TYPE ACTION
AND SPAN OF OPERATIONS
Minutes
60
50
40
30
20
10
0
HQ 1
HQ 2
OFFENSIVE
DEFENSIVE
SPAN OF OPERATIONS
1 3 6
2 5 7
1-2 3-5 6-7
SITUATIONS

FIGURE 49

AVERAGE TIME REQUIRED TO ISSUE INITIAL ORDER
EACH SITUATION

SITUATION 1		SITUATION 2	
Hq 1	Hq 2	Hq 1	Hq 2
6.3 min	6 min	4.8 min	6 min

SITUATION 3		SITUATION 5	
Hq 1	Hq 2	Hq 1	Hq 2
14 min	6.8 min	4.8 min	4.8 min

SITUATION 6		SITUATION 7	
Hq 1	Hq 2	Hq 1	Hq 2
7.7 min	7.7 min	6.6 min	8 min

Figure 50

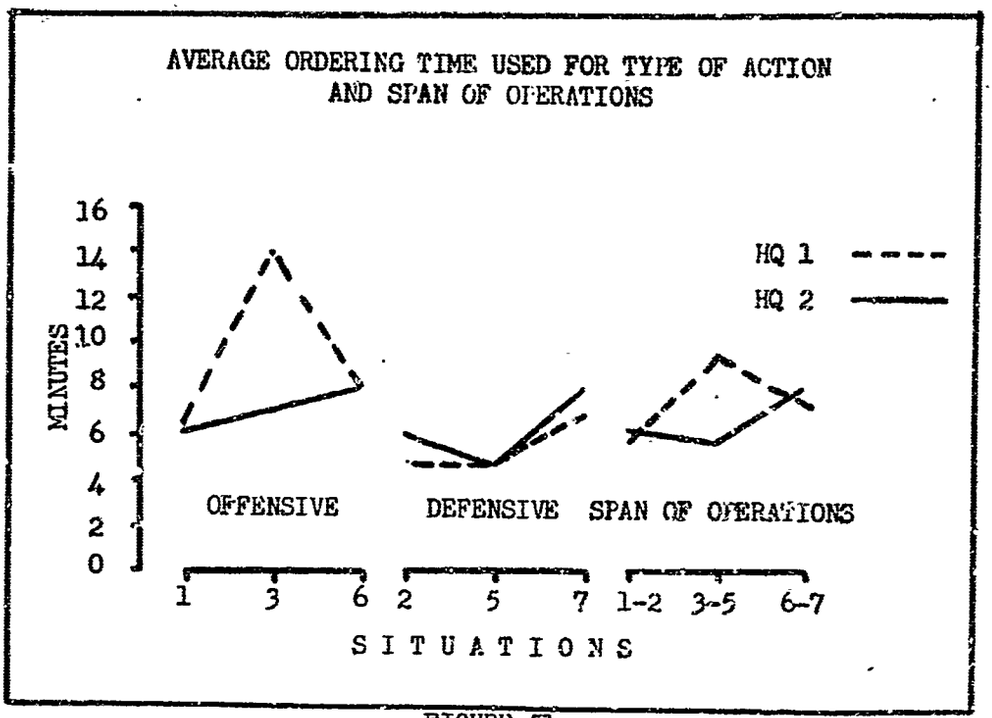

AVERAGE ORDERING TIME USED FOR TYPE OF ACTION
AND SPAN OF OPERATIONS
MINUTES
16
14
12
10
8
6
4
2
0
HQ 1
HQ 2
OFFENSIVE
DEFENSIVE
SPAN OF OPERATIONS
1 3 6
2 5 7
1-2 3-5 6-7
SITUATIONS

FIGURE 51

MOVEMENT TIMES

(Time required from beginning of movement of first unit to a defensive position or point of contact.)

	SITUATION 1		SITUATION 2	
RECORD COURSE	Hq 1	Hq 2	Hq 1	Hq 2
I	20 min	18 min	37 min	48 min
II	54	97	72	75
III	97	35	71	55
IV	69	40	45	70
	4/240/ 60.4	4/190/ 47.5	4/225/ 56.2	4/248/ 62

	SITUATION 3		SITUATION 5	
RECORD COURSE	Hq 1	Hq 2	Hq 1	Hq 2
I	63 min	(not avail) min	54 min	35 min
II	47	43	53	86
III	30	45	62	68
IV	31	20	42	30
	4/171/ 42.7	3/108/ 36	4/211/ 52.7	4/219/ 54.7

	SITUATION 6		SITUATION 7	
RECORD COURSE	Hq 1	Hq 2	Hq 1	Hq 2
I	80 min	111 min	69 min	40 min
II	94	105	37	51
III	19	15	55	36
IV	42	31	37	33
	4/235/ 58.7	4/262/ 65.5	4/198/ 49.5	4/160/ 40

Figure 52

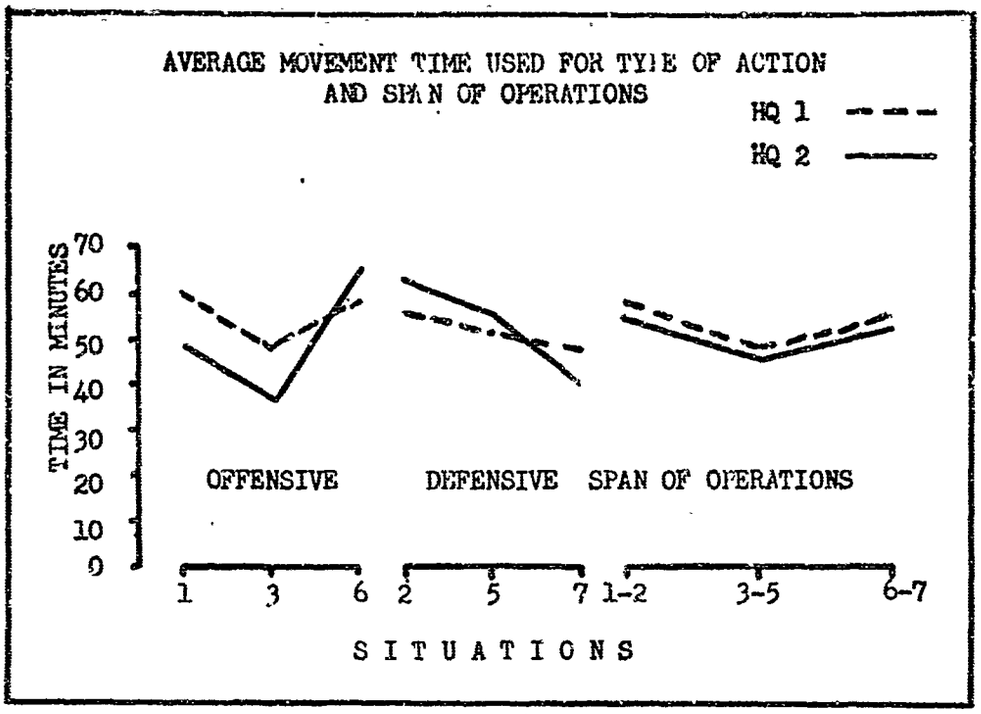

AVERAGE MOVEMENT TIME USED FOR TYPE OF ACTION
AND SPAN OF OPERATIONS
HQ 1
HQ 2
TIME IN MINUTES
70
60
50
40
30
20
10
0
OFFENSIVE
DEFENSIVE
SPAN OF OPERATIONS
1
3
6
2
5
7
1-2
3-5
6-7
SITUATIONS

FIGURE 53

AVERAGE MISSION TIME

(For Missions Accomplished)

SITUATION 1

HQ 1		HQ 2	
RC I	4:16 or 256 min	RC II	4:00 or 240 min
II	4:00 or 240 min	III	3:28 or 208 min
III	2:49 or 169 min	IV	2:42 or 162 min
IV	4:01 or 241 min		3/610/ 203 min
	4/906/ 226 min		or 2:23
	or 3:46		

SITUATION 2

HQ 1		HQ 2	
RC I	4:24	RC III	3:09

SITUATION 3

HQ 1		HQ 2
RC I	3:40 or 220 min	
II	3:34 or 214 min	None
III	3:34 or 214 min	
IV	2:35 or 155 min	
	4/803/ 200 min	
	or 3:20	

SITUATION 5

HQ 1		HQ 2	
RC I	3:36 or 216 min	RC I	3:41 or 221 min
III	4:14 or 254 min	III	2:47 or 167 min
IV	2:43 or 163 min	IV	2:06 or 126 min
	3/633/ 211 min		3/514/ 171 min
	or 3:31		or 2:51

SITUATION 6

HQ 1		HQ 2	
RC IV	3:43	RC IV	2:57

SITUATION 7

HQ 1		HQ 2	
RC II	3:09 or 209 min	RC II	3:11 or 191 min
III	3:41 or 221 min	III	3:23 or 203 min
IV	3:15 or 215 min	IV	2:22 or 142 min
	3/645/ 215 min		3/536/ 178 min
	or 3:35		or 2:58

Figure 54

MISSIONS ACCOMPLISHED AND TIME INVOLVED

RECORD COURSE I	Co A, Hq 2		Co B, Hq 1	
Situation	Time	Accomplished	Time	Accomplished
1	4:40	No	4:16	Yes
2	4:30	No	4:24	Yes
3	3:52	No	3:40	Yes
5	3:41	Yes	3:36	Yes
6	4:42	No	5:13	No
7	3:30	No	4:42	No

RECORD COURSE II	Co A, Hq 1		Co B, Hq 2	
Situation	Time	Accomplished	Time	Accomplished
1	4:00	Yes	4:00	Yes
2	3:55	No	4:05	Nc
3	3:34	Yes	3:04	No
5	3:41	No	3:30	No
6	4:51	No	4:58	No
7	3:09	Yes	3:11	Yes

RECORD COURSE III	Co A, Hq 2		Co B, Hq 1	
Situation	Time	Accomplished	Time	Accomplished
1	3:28	Yes	2:49	Yes
2	3:09	Yes	3:36	No
3	3:26	No	3:34	Yes
5	2:47	Yes	4:14	Yes
6	3:29	No	3:15	No
7	3:23	Yes	3:41	Yes

RECORD COURSE IV	Co A, Hq 1		Co B, Hq 2	
Situation	Time	Accomplished	Time	Accomplished
1	4:01	Yes	2:42	Yes
2	3:26	No	2:58	No
3	2:35	Yes	3:11	No
5	2:43	Yes	2:06	Yes
6	3:43	Yes	2:57	Yes
7	3:15	Yes	2:22	Yes

SUMMARY OF MISSIONS ACCOMPLISHED

Situation	Hq 1	Hq 2
1	4	3
2	1	1
3	4	0
5	3	3
6	1	1
7	3	3
	16	11

Figure 55

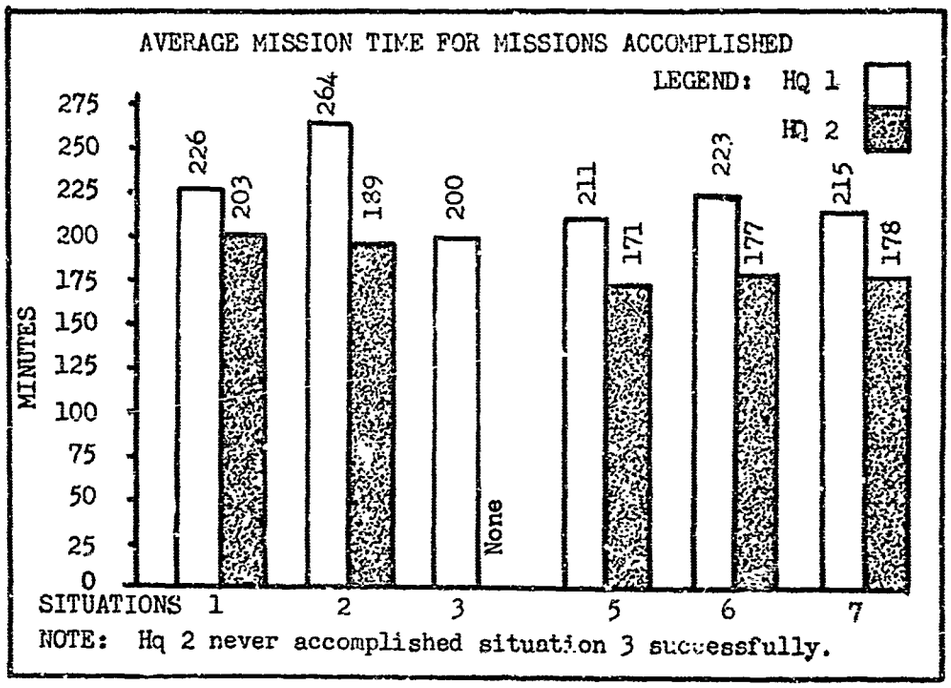


FIGURE 56

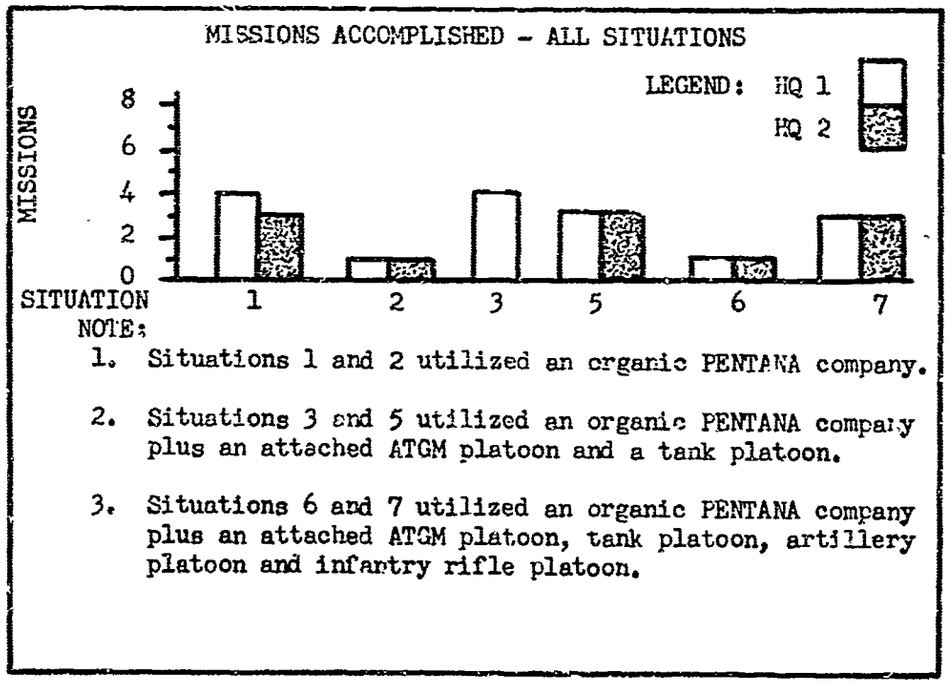


FIGURE 57

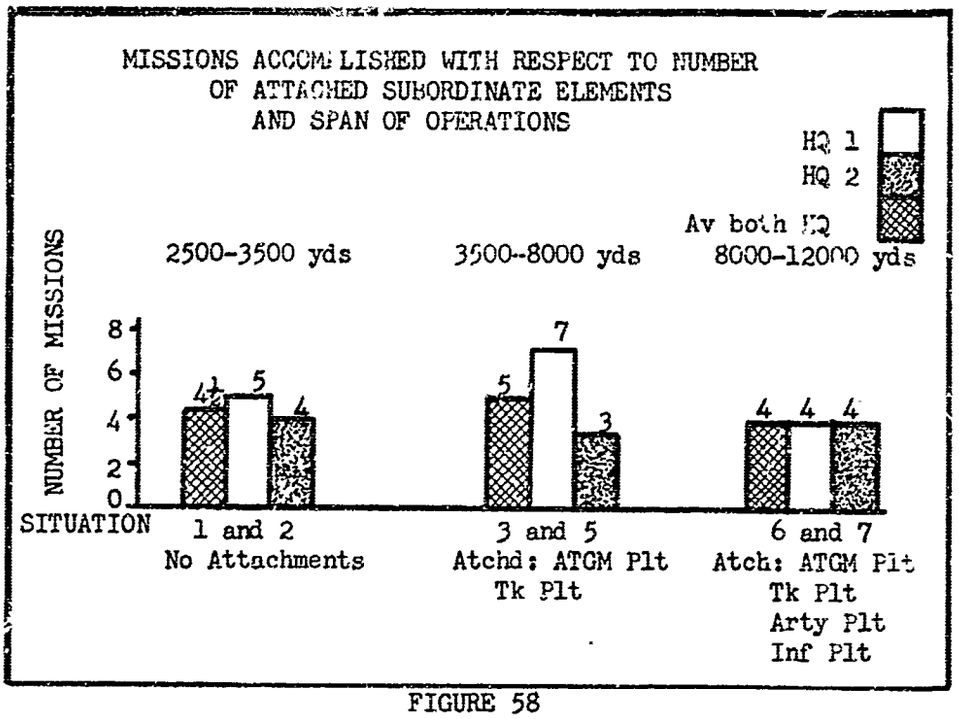


FIGURE 58

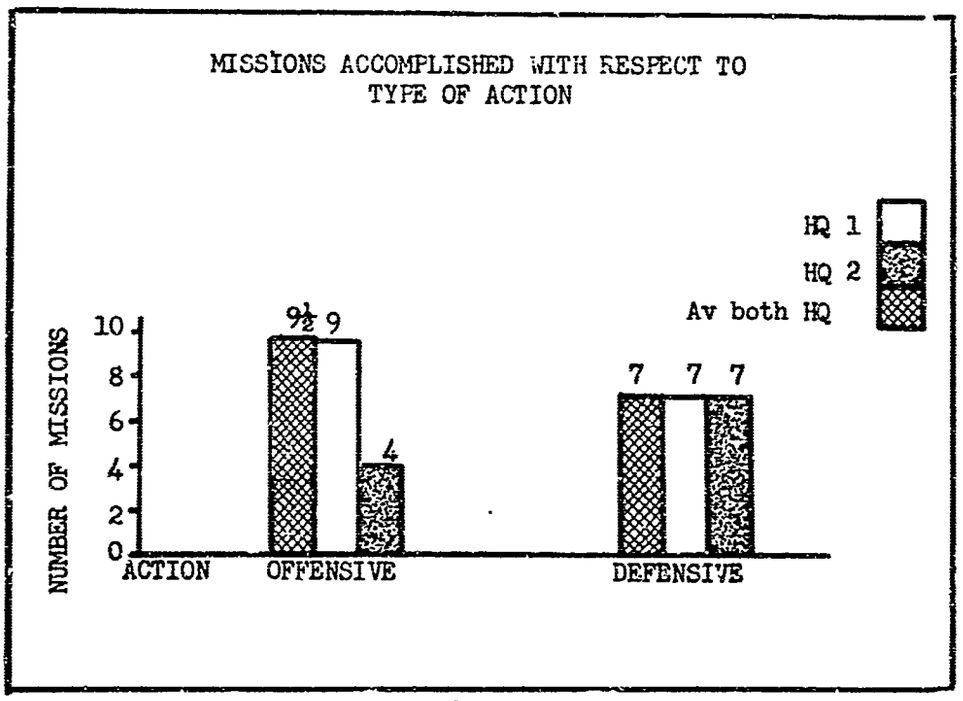


FIGURE 59

SUMMARY OF COMPARISONS OF INDICATORS

INDICATOR	RESULTS
Planning Time	The average of planning time required by each type headquarters for all situations is:
	Hq 1 / Hq 2
	Situation Nr 1 and Nr 2 (no attachments): 37.6 / 35.6
	Situation Nr 3 and Nr 5 (2 attachments): 37.0 / 42.6
	Situation Nr 6 and Nr 7 (4 attachments): 43.6 / 44.6
	Averages - Headquarters 1: 39.2 minutes Headquarters 2: 40.7 minutes
Ordering Time	The average time to issue orders required by each headquarters for all situations is:
	Hq 1 / Hq 2
	Situation Nr 1 and Nr 2 (no attachments): 5.5 / 6.0
	Situation Nr 3 and Nr 5 (2 attachments): 9.4 / 5.5
	Situation Nr 6 and Nr 7 (4 attachments): 7.2 / 7.8
	Averages - Headquarters 1: 7.2 minutes Headquarters 2: 6.4 minutes
Movement Time	The average movement time employed by each headquarters for all situations is:
	Hq 1 / Hq 2
	Situation Nr 1 and Nr 2 (no attachments): 58.3 / 59.7
	Situation Nr 3 and Nr 5 (2 attachments): 52.7 / 45.3
	Situation Nr 6 and Nr 7 (4 attachments): 54.1 / 52.7
	Averages - Headquarters 1: 55 minutes Headquarters 2: 52.5 minutes.

Figure 60

INDICATOR	RESULTS
Mission Time	The average time required to accomplish those missions which were successfully completed is as follows: Situation Nr 1 and Nr 2 (no attachments): 9 missions accomplished in average time of 3 hours 40 minutes. Situation Nr 3 and Nr 5 (2 attachments): 10 missions accomplished in average time of 3 hours 14 minutes. Situation Nr 6 and Nr 7 (4 attachments): 8 missions accomplished in average time of 3 hours 8 minutes. Average - Headquarters 1: 3 hours 43 minutes Headquarters 2: 3 hours 3 minutes
Percentage of Missions Accomplished with Respect to Span of Control and Number of Attachments	Of 48 missions attempted at 2500-3000 yards, 3500-8000 yards and 8000-12000 yards the percentage of successful accomplishments is as follows: 2500-3500 yards: (no attachments) 50.6% 3500-8000 yards: (2 attachments) 62.5% 8000-12000 yards: (4 attachments) 50%

Figure 60 (continued)

SECTION VII

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 4

44. Statement of Objective:

To determine the extent to which the several types of company headquarters can maintain continuous communications with subordinate elements when operating over extended distances.

45. Indicator:

Communication Outages.

46. Presentation of Data:

Figure 61 presents a list of radio communication equipment by type which was employed by each experimental company and the elements which were attached to the rifle company during certain situations. This figure indicates that one experimental rifle company with an attached ATGM section, tank platoon, artillery platoon, and one additional rifle platoon utilized a total of 94 radios with 2 additional radios when Headquarters 2 was utilized. Figures 62 and 63 reflect communication outages of experimental forces, by record course, company and type headquarters and by span of operations. Also indicated are the type of radio failures experienced by experimental forces when such could be determined.

47. Discussion:

a. The communication equipment listed was employed throughout all phases of the experimentation when the company organization was operating with Headquarters 1. In those situations where the companies were employed under Headquarters 2 the

organic communication equipment was augmented by two 2) AN/VRC-18 radios for use by the Reconnaissance and Operations Officer.

b. The VRQ series radios normally employed by armored units were used in this experiment. Since the technical proficiency of the radio sets used had been tested and accepted by appropriate Army agencies prior to adoption of the sets as standard models, no attempt was made to measure their adequacy in this regard. Rather, consideration was given to whether or not the company headquarters was capable of maintaining continuous communications with the organic and attached elements of the company organization during military operations over frontages ranging from 2500-12000 yards. The resolution of this problem does not readily lend itself to scientific or military comparisons; therefore, personal observations of and [illegible] records maintained by controller personnel serve as the basis for the conclusions that follow.

c. For comparison and analysis, 48 separate situations were run by the two experimental companies involved. During 16 of the situations, 51-53 radios were used in each; 60-62 radios in 16 situations and 94-96 radios in 16 situations. Thus, in 48 situations 2928 radio situations were analyzed. From records available, there were only 59 instances of communication outages by experimental forces in these situations. Of the 59 outages by experimental forces, 29 are attributed to mechanical failure; 24 to distance and terrain, and the remainder are unexplainable. Further examination of data available indicated that 23 of the outages occurred when the company was operating without attachments on a frontage of 2500-3500 yards; 18 occurred when the company had an ATGM section and tank platoon attached on a frontage of 3500-8000 yards and 18 occurred when the company had 4 attached units with 43 additional radios on a frontage of 8000-12000 yards. Troops operating with Headquarters 1 had 40 recorded radio outages whereas troops under Headquarters 2 which had two additional radios AN/VRC-18 experienced only 18 outages.

48. Conclusion:

Both type rifle company headquarters, utilizing the communications equipment prescribed for the experiment (the VRQ series currently employed in armored infantry companies), had the capability of maintaining continuous radio communications with subordinate elements over distances up to 12000 yards. Radios were nearly 98% effective, with only 59 recorded outages in 2928 radio situations (number of radios employed times number

of situations). The attachment of four additional subordinate elements to the rifle company had no apparent adverse effects on the communications capability of the company.

49. Recommendation:

That the VRQ series of all current radios be adopted as standard communications within company level elements of the combat arms.

LIST OF COMMUNICATIONS EQUIPMENT

RADIO COMMUNICATIONS EQUIPMENT - RIFLE COMPANY

AN/VRQ-3	- 1	AN/GRC-8	- 20
AN/VRC-18	- 2 (2 additional w/Hq 2)	AN/PRC-6	- 13
AN/GRC-7	- 10	AN/PRC-10	- 5

Total 52

RADIO COMMUNICATIONS EQUIPMENT - ATGM SECTION

AN/VRC-18	- 2	AN/PRC-10	- 2

Total 4

RADIO COMMUNICATIONS EQUIPMENT - TANK PLATOON

AN/CRC-7	- 1	AN/GRC-8	- 4

Total 5

RADIO COMMUNICATIONS EQUIPMENT - ARTILLERY PLATOON

AN/VRQ-3	- 1	AN/GRC-8	- 8
AN/VRC-18	- 4	AN/PRC-6	- 6
AN/GRC-7	- 2	AN/PRC-10	- 4

Total 25

RADIO COMMUNICATIONS EQUIPMENT - RIFLE PLATOON

AN/GRC-7	- 2	AN/PRC-6	- 2
AN/GRC-8	- 4	AN/PRC-10	- 1

Total 9

Figure 61

COMMUNICATIONS FAILURES

Failures	RC	CO	C.O.	Hq
4	RC I	A Co	Maj	Hq 2
11	RC I	B Co	Capt	Hq 1
11	RC II	A Co	Maj	Hq 1
5	RC II	B Co	Capt	Hq 2
3	RC III	A Co	Capt	Hq 2
6	RC III	B Co	Maj	Hq 1
13	RC IV	A Co	Capt	Hq 1
6	RC IV	B Co	Maj	Hq 2
59				

SITUATION	US RADIO OUTAGES	FRONTAGES
1	13	2,500 - 3,500 yds
2	10	2,500 - 3,500 yds
3	9	3,500 - 8,000 yds
5	9	3,500 - 8,000 yds
6	13	8,000 -12,000 yds
7	5	8,000 -12,000 yds

Figure 62

FAILURE TYPES

MECHANICAL FAILURES . . . 29

DISTANCE AND TERRAIN . . 24

UNKNOWN 6

TYPE HEADQUARTERS

Hq 1	Hq 2
41 Outages	18 Outages

lgure 63

SECTION VIII

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 5

50. Statement of Objective:

To obtain maximum factual data to assist in the determination of the most appropriate rank for the Company Commander.

51. Indicators:

In an effort to determine the appropriate rank for the Company Commander, examination has been made of the differences in performance of the various Captains and Majors commanding the Headquarters 1 and Headquarters 2 Organizations and by comparing their performance in the defensive and offensive situations at the various spans of operation. Comparisons have been made of the following areas:

a. Planning time.

b. Ordering time.

c. Movement time (Time required from beginning of movement of first unit to arrival of the first unit to a defensive position or point of contact - not necessarily the same unit).

d. Mission time (Total time utilized from time Company Commander receives order until end of situation).

e. Results obtained in the use of nuclear devices.

f. Casualties suffered from own nuclear devices.

g. Ratio of vehicular casualties suffered to vehicular casualties inflicted.

h. Frequency of mission accomplishment.

i. Unit effectiveness retained. (This is a weighted measure to compare effectiveness of companies. It takes into account those vehicles, weapons, and platoons which are left at the end of any common length of time during a situation. The measure E=(V + W)P/S max is the number compared, where V, W, and P are numbers associated with relative value of vehicles, weapons, and platoon strength and where S max is a figure representing 100% strength at the beginning of a situation.) Following are the weighted values used for vehicles, weapons, and numbers of vehicles remaining within the platoon:

VEHICLE		WEAPON		PLATOON FACTOR	
TYPE	VALUE	TYPE	VALUE	NO OF VEH REMAINING IN PLT	VALUE
LAV-4	1	3.5	1	1	1
APC	1	106	3	2	3
TANK	2	90mm	5	3	3.5
		ATGM	5	4	3.5
		MORTAR	1	5	3.5
		ARTY	2	6	3.5

52. Presentation of Data:

a. Planning Time:

Figure 64 is a graphical presentation of the average planning times comparing Captains and Majors commanding like headquarters for like situations.

b. Ordering Time:

Figure 65 is a graphical presentation of the average ordering times comparing Captains and Majors commanding like headquarters for like situations.

c. Movement Time:

Figure 66 is a graphical presentation of the average movement times comparing Captains and Majors commanding like headquarters for like situations.

d. Mission Time:

Figure 67 is a graphical presentation of the average mission times comparing Captains and Majors commanding like headquarters for like situations.

e. Vehicle Casualties Inflicted Per Nuclear Device:

Figure 68 is a graphical presentation of the average number of vehicular casualties inflicted on aggressor per nuclear device comparing Captains and Majors commanding like headquarters for like situations.

f. Vehicular Casualties Suffered From Own Nuclear Devices:

Figure 69 is a graphical presentation of average number of casualties suffered from own nuclear devices comparing Captains and Majors commanding like headquarters for like situations.

g. Ratio of Vehicle Casualties Suffered to Casualties Inflicted:

Figures 70 and 71 are graphical presentations of the percentage of vehicle casualties inflicted and sustained comparing Captains and Majors commanding like headquarters for like situations.

h. Frequency of Mission Accomplishments:

Figure 72 is a graphical presentation of frequency of missions accomplished for each span of control when comparing Captains and Majors commanding like headquarters.

i. Unit Effectiveness:

Figure 73 is a graphical comparison of unit effectiveness after one hour of contact with the enemy comparing Captains and Majors commanding like headquarters for like situations.

53. Discussion:

a. General:

(1) This objective stemmed from the CONARC recommendation that the rifle company commander of the ROCID and ROTAD divisions required the rank of major. The objective was superimposed on the basic experimental design during the later stages of the detailed planning for the experiment.

(2) From the time that planning for the objective was initiated, it was realized that it would be most difficult, in the limited number of comparative situations that time permitted, to produce definitive answers to the question of rank. The problem was approached from the standpoint of examining the comparative performance of Captains and Majors who were considered to represent the average capabilities of these grades. Prior to the procurement of the candidate officers appropriate qualifications in terms of length of service, time in grade, military schooling, combat experience, and age were established. Unfortunately, the officers furnished did not fully meet the criteria established for the experiment. Furthermore, except for a 3 week exposure to PENTANA-Type company organizational and operational concepts, their common level of experience, background, and training was associated with the tactics and techniques of World War II and Korea. Only half of the candidates had experience with the ROCID concepts. Therefore, with meagre indoctrination in the operational concepts to be employed, it could hardly have been expected that major differences could be detected that were not associated with or confounded by the inherent quickness, ingenuity, or perspicuity of the individual involved. However, in the face of these difficulties, every effort was made to gather data having a b[illegible] appropriate command rank.

(3) In th final analysis, appropriate rank cannot be determined--whether Regular Army, Reserve or National Guard officers are considered--until factors such as the following are established:

(a) What qualifications are desired?

(b) What selection system is needed?

(c) How much training time is required?

(4) Relative to the factors outlined in paragraph (3) above, military observations during the course of the experiment emphasized the following:

(a) Regardless of rank, dispersion and increased firepower had forced increased responsibilities on the company commander. It follows that he must possess the background and military characteristics traditionally associated in the past with higher commanders.

(b) The company commander must be afforded complete authority within his assigned mission and area of responsibility.

(c) The company commander no longer exerts influence by his physical presence at the scene of action. He is most successful when he delegates authority and means to his platoon leaders and maintains his command post at a location insuring the best possibility of continuous communications with subordinate, supporting, adjacent, and higher echelons and to provide support which is available to him and not his subordinates.

(d) The company commander must be carefully trained to have a complete understanding of the capabilities and limitations of every means available to him.

(e) The terrific premium on speed and accuracy in the environment of dispersed mobility and nuclear warfare was apparent in the experiment. The company commander on the nuclear battlefield must be inherently able and quick—the average, be he captain or major, will not suffice.

(5) In general, each indicator is examined in the following paragraphs of this section for differences between captain and major while conducting offensive and defensive missions.

(a) Planning Time:

In the offensive missions, no significant differences were observed between Captains and Majors. On the defense, the Captains' average time of 42.4 minutes was significantly different from the Majors' time of 33.3 minutes considering an error time of only 2.2 minutes.

(b) Ordering Time:

No significance is observed relative to differences while the candidates were on the offense. However, in defensive situations the Captains' average time of 5.2 minutes is significantly different from the Majors' average time of 6.7 minutes with the associated error of .8 minutes.

(c) Movement Time:

There are no significant differences observed between candidates on either offense or defense.

(d) Mission Time:

Captains and Majors showed no significant differences in time to accomplish their offensive or defensive missions.

(e) Vehicle Casualties Inflicted Per Nuclear Device:

There were no significant differences between candidates relative to this indicator on either offense or defense.

(f) Vehicular Casualties Suffered From Own Nuclear Devices:

While on the offense the Major lost an average of 4.6 vehicles per situation and the Captain 2.3 vehicles. This difference is statistically significant since the error team is 1.5 casualties. No such significant difference exists while they are conducting defensive missions.

(g) Ratio of Vehicle Casualties Suffered to Casualties Inflicted:

Neither offensive or defensive missions produced significantly different casualty ratios between Captain and Major.

(h) Frequency of Mission Accomplishment:

Considering offensive and defensive missions separately, no significant differences existed between Captain and Major. However, breaking the data down by span did show a significant difference between Captain and Major on the 2500 - 3500 yard front, when the Captain accomplished this mission 75% of the time and the Major accomplished this mission 38% of the time. The error associated with each is 16%. The other spans show no significant differences.

(i) Unit Effectiveness:

No significant differences can be shown to exist with regard to this criterion.

(j) Qualifications of Commanders:

The background data of the experimental Company Commanders reflected that they were of outstanding ability and intelligence. All had seen combat in Korea, with three of the Majors having had WW II combat duty. All were graduates of their advanced branch of service courses. Three of the four Captains were college graduates; none of the Majors were. All the Captains were assigned to command positions. The average time since the Majors last commanded troops was in excess of five years. It is felt that the only portion of the above-mentioned data which could have a bearing on the result of the experiment would be the average time lapse since the Majors last occupied a command position. In the few aspects where the Captains excelled the Majors, it appears that the Captain's command assignment, or short time since command assignment, as compared to the relatively long average time since command assignments of the Majors, contributed to the difference.

1. There is little on which to base a choice of ranks. At the .25 confidence level, there were only four indicators out of the 33 that showed apparent differences. If there are differences in Captains and Majors in a command function, this experiment did not find them and further experimentation to detect them must develop new criteria which are meaningful and new procedures tailor-made for these criteria.

2. In considering some phases of command, it is felt that the results could have been different had both ranks of officers had equal education and, perhaps more important, had equal lengths of time since last performing a command assignment. In all cases, the Majors were faced with the problem of readjusting to a command function.

54. Conclusions:

On the basis of the data developed in this experiment, there is no evidence of significant differences in the performance capabilities of the captains and majors tested.

AVERAGE PLANNING TIME COMPARING CAPTAIN AND MAJOR COMMANDING LIKE HEADQUARTERS FOR LIKE SITUATIONS

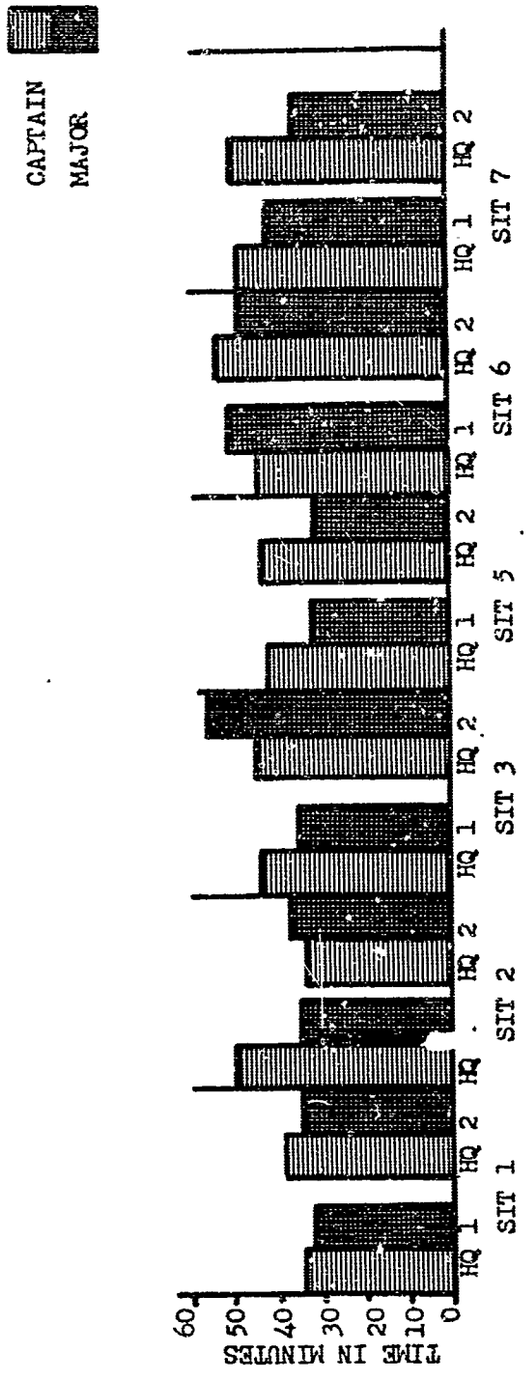


FIGURE 64

AVERAGE ORDERING TIME COMPARING CAPTAINS AND MAJORS
COMMANDING LIKE HEADQUARTERS FOR LIKE SITUATIONS

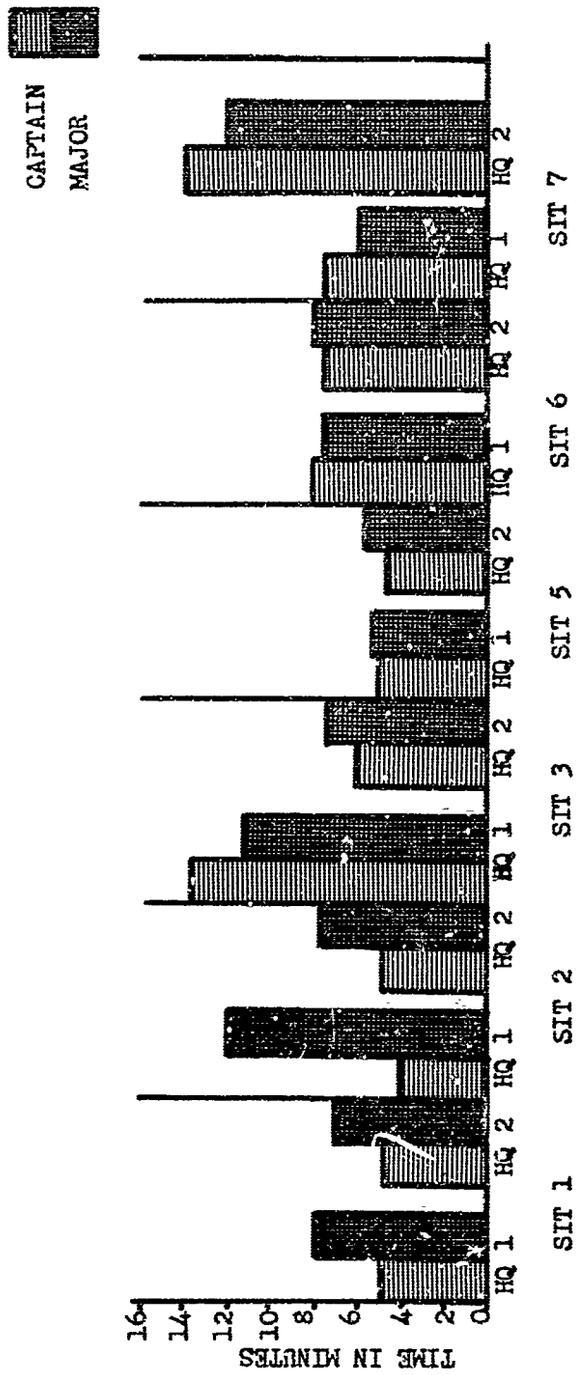


FIGURE 65

AVERAGE MOVEMENT TIME COMPARING CAPTAIN AND MAJOR
COMMANDING LIKE HQS FOR LIKE SITUATIONS

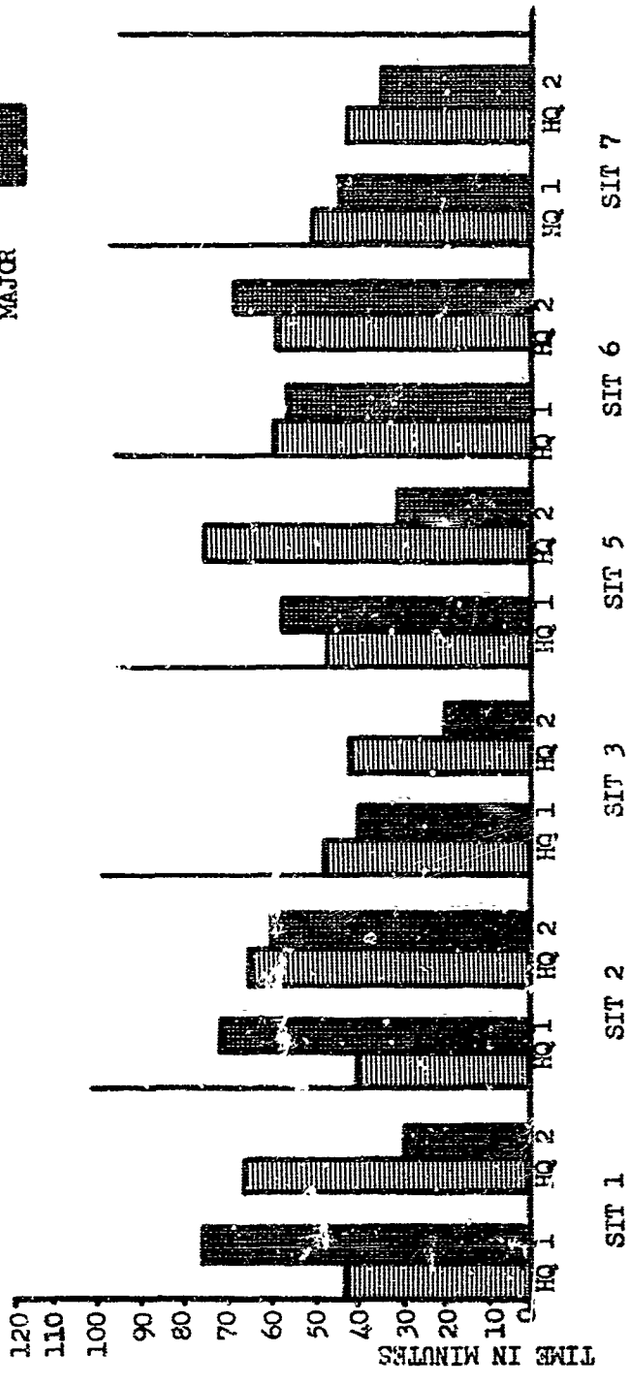


FIGURE 66

AVERAGE MISSION TIMES BY COMPARING CAPTAIN AND MAJOR COMMANDING LIKE HQ FOR LIKE SITUATIONS

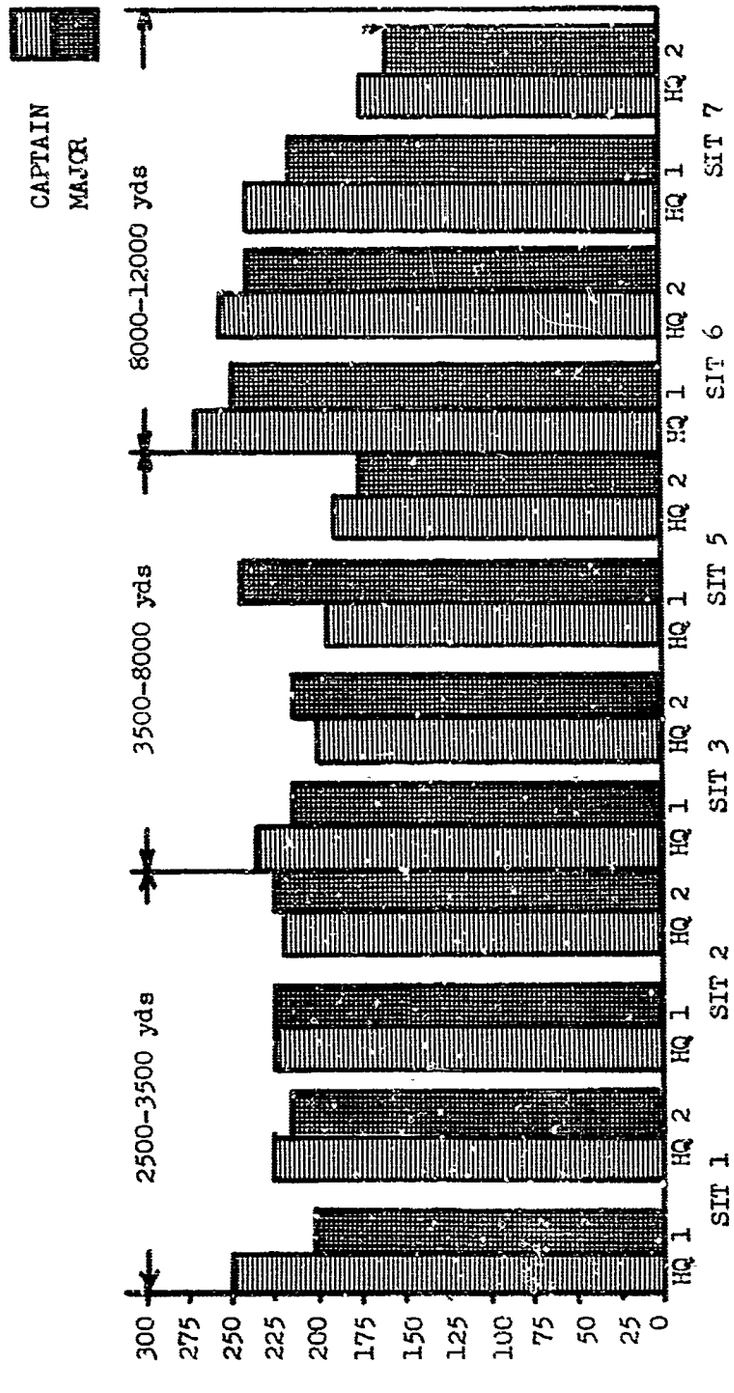


FIGURE 67

COMPARISON OF THE CAPTAIN AND MAJOR COMMANDING LIKE HQ BY SHOWING
AVERAGE CASUALTIES INFLICTED ON AGGRESSOR PER NUCLEAR STRIKE FOR LIKE SITUATIONS

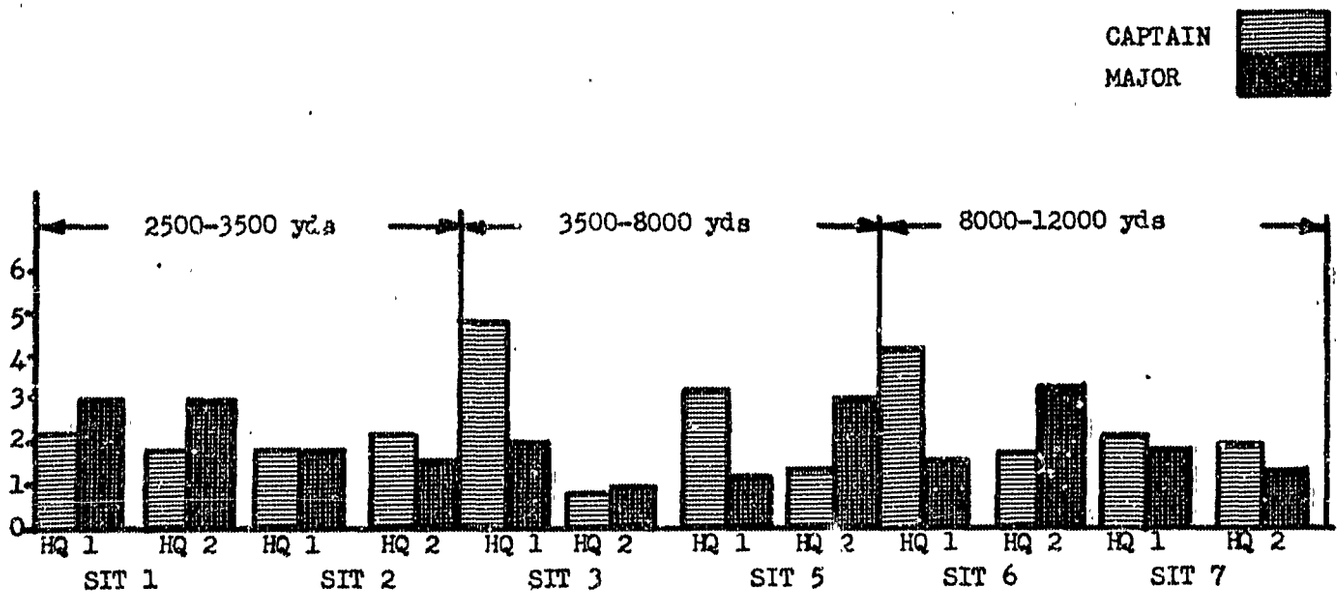


FIGURE 68

CONFIDENTIAL—MODIFIED HANDLING AUTHORIZED

CASUALTIES SUFFERED FROM OWN NUCLEAR DEVICES BY THE
CAPTAIN AND MAJOR WHEN COMMANDING LIKE HQ FOR LIKE SITUATIONS

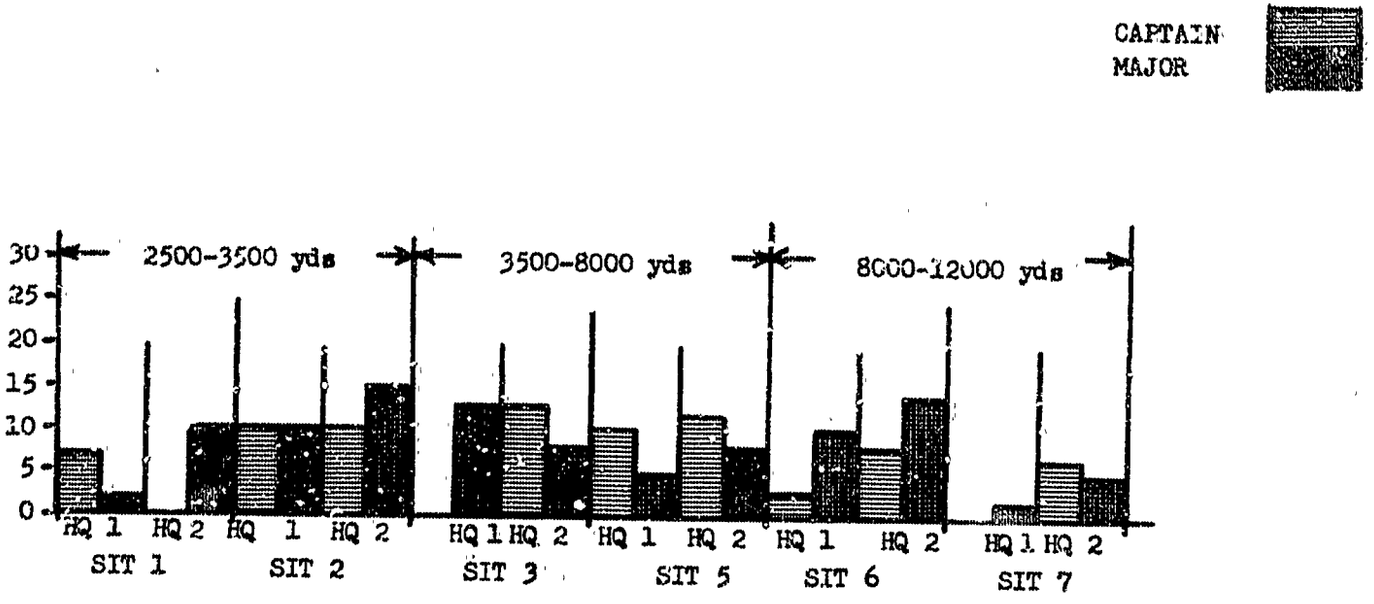


FIGURE 69

CONFIDENTIAL—MODIFIED HANDLING AUTHORIZED

PERCENT OF VEHICLE CASUALTIES INFLICTED AND SUSTAINED BY THE
CAPTAINS AND MAJORS WHEN COMMANDING LIKE HEADQUARTERS FOR LIKE OFFENSIVE SITUATIONS

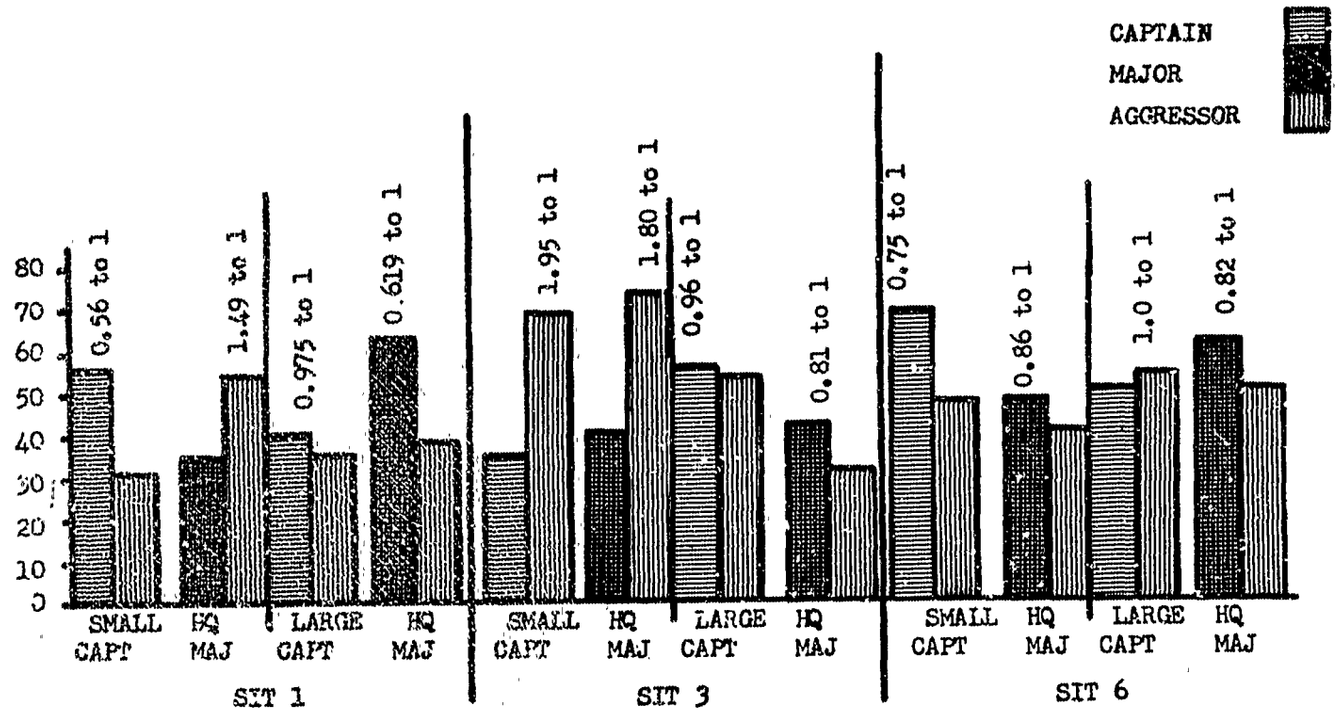


FIGURE 70

CONFIDENTIAL—MODIFIED HANDLING AUTHORIZED

PERCENTAGE OF VEHICLE CASUALTIES INFLICTED AND SUSTAINED BY THE CAPTAINS AND MAJORS WHEN COMMANDING LIKE HEADQUARTERS FOR LIKE DEFENSIVE SITUATIONS

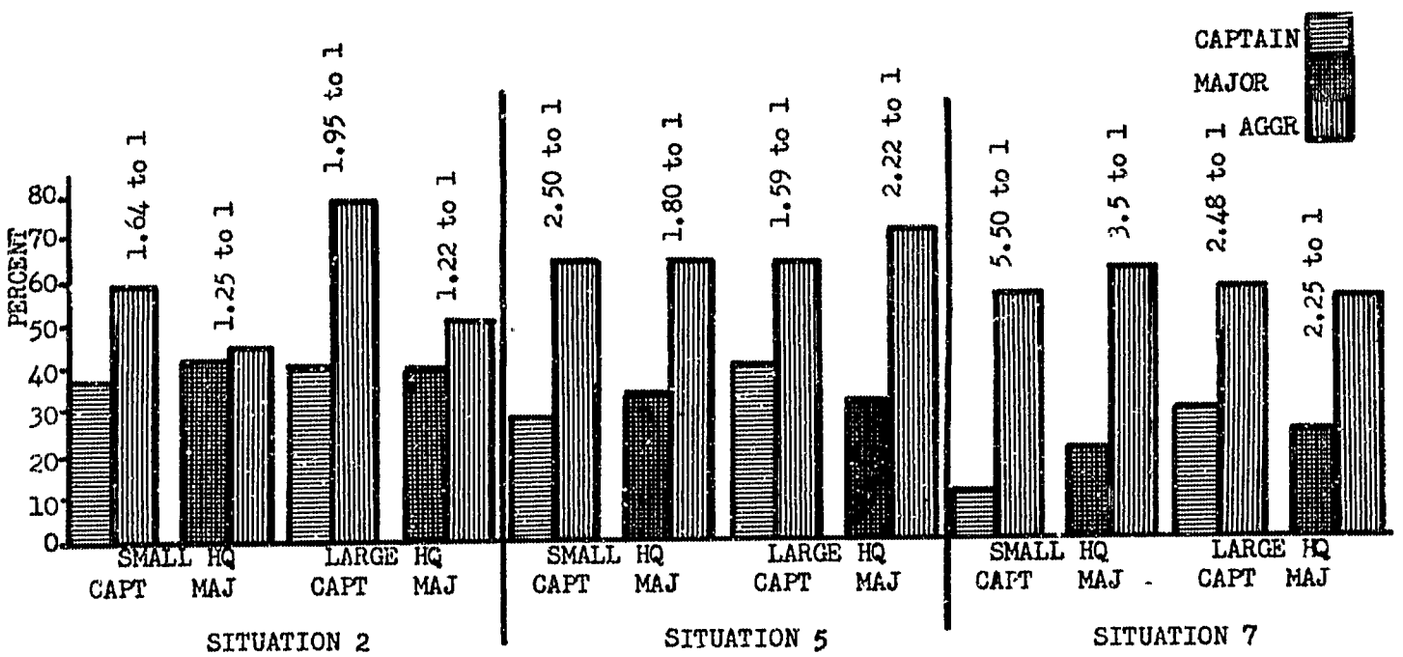


FIGURE 71

FREQUENCY OF MISSIONS ACCOMPLISHED BY COMPARING THE CAPTAIN AND MAJOR COMMANDING LIKE HEADQUARTERS FOR EACH SPAN OF CONTROL

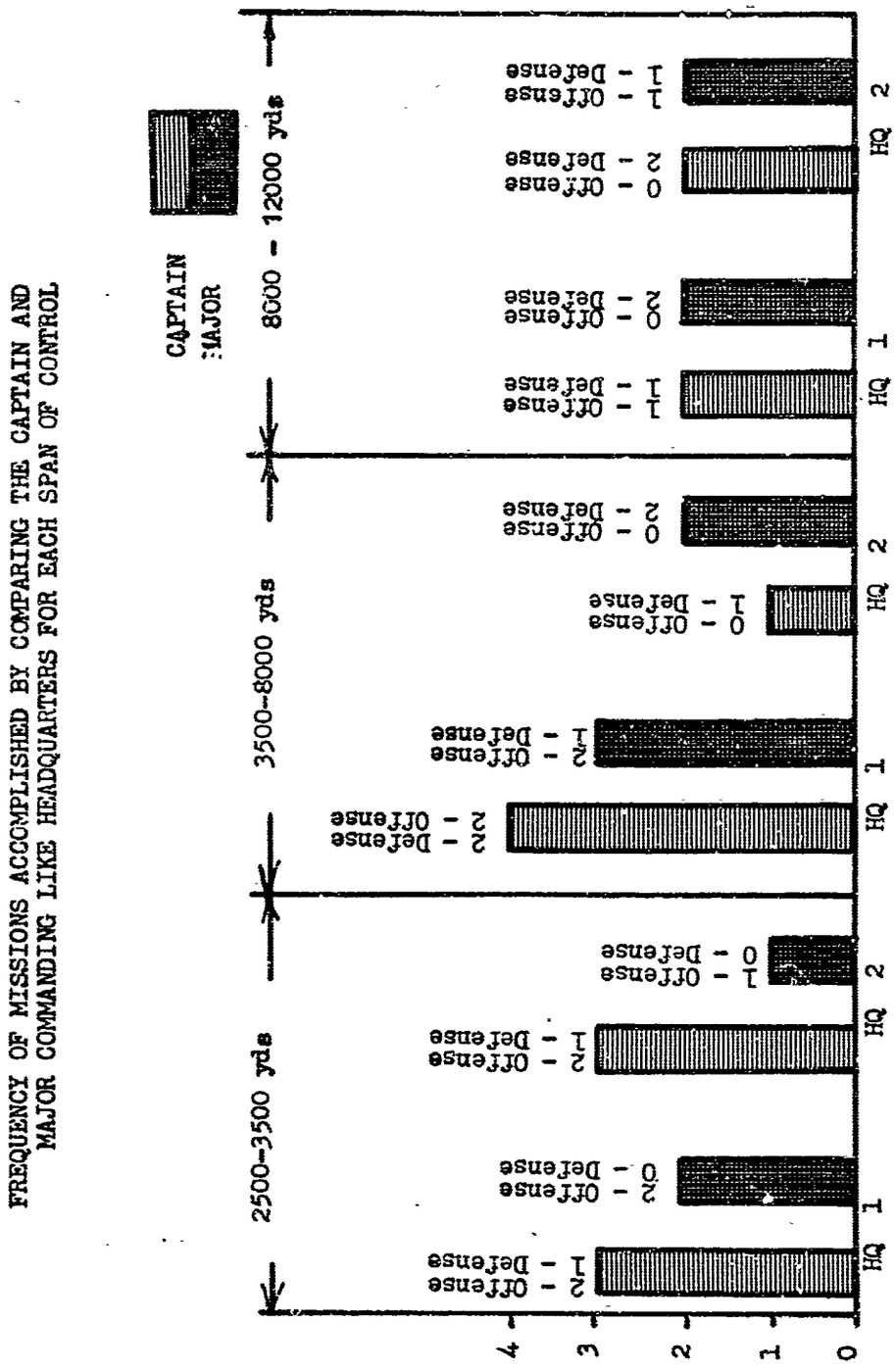


FIGURE 72

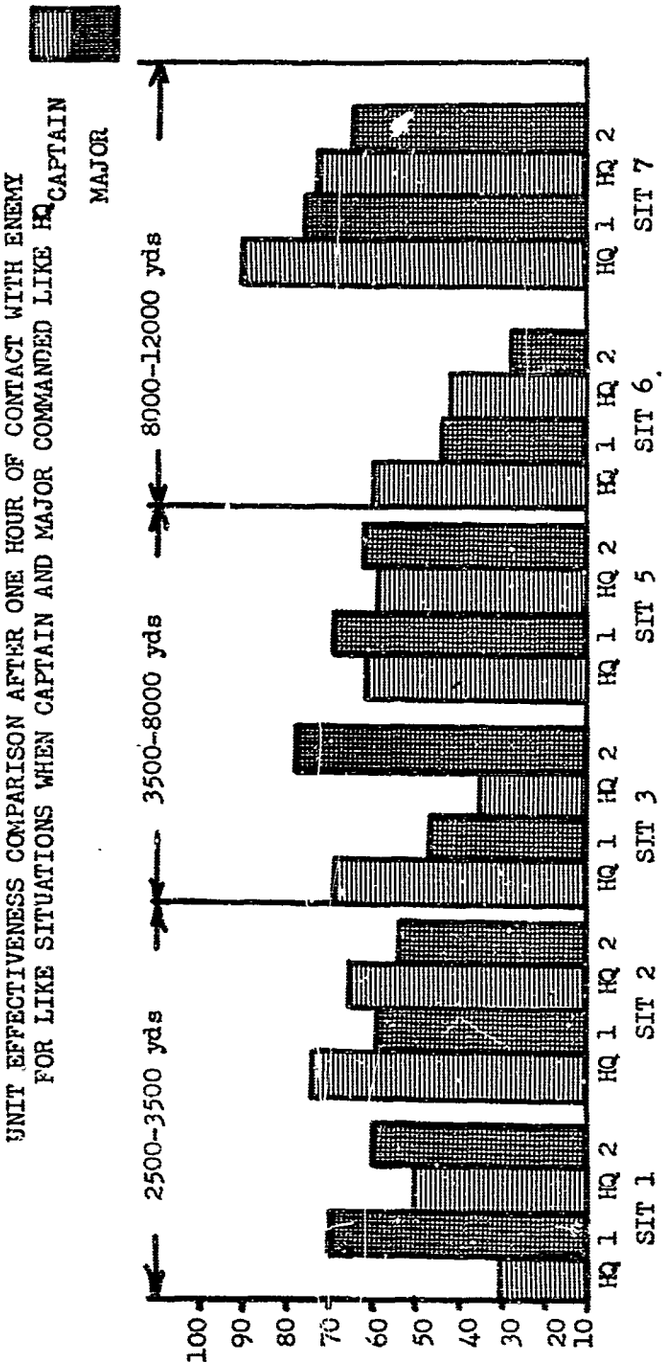

UNIT EFFECTIVENESS COMPARISON AFTER ONE HOUR OF CONTACT WITH ENEMY
FOR LIKE SITUATIONS WHEN CAPTAIN AND MAJOR COMMANDED LIKE HQ
CAPTAIN
MAJOR
2500-3500 yds
3500-8000 yds
8000-12000 yds
100
90
80
70
60
50
40
30
20
10
HQ 1 HQ 2
SIT 1
HQ 1 HQ 2
SIT 2
HQ 1 HQ 2
SIT 3
HQ 1 HQ 2
SIT 5
HQ 1 HQ 2
SIT 6
HQ 1 HQ 2
SIT 7

FIGURE 73

SECTION IX

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 6

55. Statement of Objective:

To determine the logistic support requirements generated by the rifle company.

For discussion, conclusions and recommendations see Volume II.

SECTION X

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

OBJECTIVE 7

56. Statement of Objective:

To investigate techniques of aerial resupply and maintenance of the rifle company.

For discussion, conclusions and recommendations see Volume II.

SECTION XI

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

ARTILLERY OBJECTIVES

57. Statement of Objectives:

For statement of objectives, discussion, conclusions and recommendations pertaining thereto see Volume II.

SECTION XII

(CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED)

DAVY CROCKETT OBJECTIVES

58. Statement of Objectives:

For statement of objectives, discussion, conclusions and recommendations pertaining thereto see Volume IV.

SECTION XIII

SUPPLEMENTARY CONCLUSIONS AND RECOMMENDATIONS

59. (U) **Introduction:**

This section provides a presentation of the conclusions and recommendations resulting from an analysis of the recorded data and military observations within the experimental environment which are not specifically applicable to the experimental objectives. These conclusions and recommendations are presented as they relate to:

a. Mission accomplishment capabilities.

b. Tactical doctrine.

c. Command and control of PENTANA-type companies and their subordinate elements.

The conclusions are considered valid in light of the environment in which they were generated.

60. (C) **Mission Accomplishment Capabilities:**

a. **General:**

Mission accomplishment capabilities are concerned with a determination of the capability of the company to accomplish offensive and defensive missions using non-nuclear and nuclear weapons. On the basis of examination of the recorded data and military evaluation definite conclusions can be drawn on these three areas:

(1) The influence of low-yield nuclear devices.

(2) Appropriate numbers of nuclear devices at company level.

(3) The relative importance of non-nuclear weapons.

b. The Influence of Low-Yield Nuclear Devices:

(1) Data:

Figure 74 indicates the percentage of nuclear and non-nuclear casualties, both friendly and enemy.

(2) Discussion:

Approximately 61.5% of the vehicular casualties inflicted by the experimental force on the aggressor was due to the use of nuclear weapons. Thirty-seven percent of the vehicular casualties inflicted by aggressor on the experimental force was from nuclear devices. Each side had a certain percentage of casualties sustained from its own deliveries of nuclear fires, about 3.5% in the case of aggressor and about 13.2% in the case of the experimental force.

(3) Conclusions:

Within the framework of this experiment (complete mechanization of experimental and aggressor forces and relatively unlimited availability of tactical nuclear munitions), the low-yield tactical nuclear weapons system emerged as the dominant and controlling influence on the battlefield as indicated by the following statistics:

	EXPERIMENTAL FORCE CASUALTIES	AGGRESSOR FORCE CASUALTIES
From Experimental Force Nuclear Weapons	13.2%	61.5%
From Aggressor Force Nuclear Weapons	37.0%	3.5%
Total Casualties from Nuclear Weapons	50.2%	65.0%

(4) Recommendation:

That current tactical doctrine and training directives be appropriately revised to reflect the dominance of low-yield tactical nuclear weapons and the requirement for habitual dispersed tactics in training and field exercises and a necessity for armored protection of all elements in the forward combat areas.

c. Appropriate Numbers of Nuclear Devices at Company Level:

(1) Data:

Figure 75 indicates the number of low-yield nuclear weapons employed per record week and indicates the average vehicular casualties per weapon during these weeks.

(2) Discussion:

Figure 75 shows the point of diminishing returns and results that can be expected by the application of sheer numbers. Note that in the final 3 weeks of record runs, the experimental force fired a relatively large number of nuclear weapons, but that the vehicular casualties per shot, about 1.8, were lower in comparison to a more discriminant use of the weapon in the first record course which resulted in 3.2 vehicles per shot. The reason that commanders in that experiment were given relative freedom in the employment of nuclear weapons was to encourage them to use nuclear weapons in order that there could be obtained a better measurement and understanding of their impact on the battlefield. In subsequent experimentation, it is contemplated that closer control will be exercised in the use of nuclear weapons.

(3) Conclusion:

Experimentation developed indications of a point of diminishing returns with regard to number of tactical nuclear weapons employed at company level on a dispersed battlefield.

(4) Recommendations:

These CONARC training directives contain guidelines relative the number of small-yield tactical nuclear weapons that may be made available for direct support of company level units in offensive and defensive operations during training and field exercises.

d. The Relative Importance of Non-Nuclear Weapons:

(1) Data:

Figures 76 and 77 indicate the breakdown of experimental force and aggressor casualties by causative agent.

(2) Discussions:

(a) Experimentation during the eight record runs reveal that nuclear weapons and direct fire tank-antitank weapons accounted for over 99% of experimental force casualties and over 98% of aggressor casualties. Figure 76 indicates that the bulk of experimental force casualties was about evenly divided between those resulting from direct fire tank-antitank weapons. Of the direct fire casualties, 19% were from 106 recoilless rifles, 13% from 3.5 rocket launchers and 18% from 90mm tank guns. There was a very negligible percentage of casualties received from artillery (.8%), from mortars (.1%) and from small arms (.1%). Figure 77 reveals that the percentage of nuclear casualties in the aggressor force was higher than casualties from direct fire weapons. In this case, 106 recoilless rifles caused 14.6%, 3.5 rocket launchers 8.7%, ATGM 5.2% and 90mm tank fires 5.1%. Here again, there were negligible losses from non-nuclear artillery, mortar, and small arms fire.

(b) Within the mechanized, mobile environment of the experiment, dominated by the tactical nuclear weapons system, the occasions for employment of not only non-nuclear artillery fires, but also mortar fires diminished at an astonishing rate from record week to record week. In fact the 81mm mortar carriers, to which 106mm recoilless rifles were added for AT defense of the mortar platoon, were attached to or positioned with the forward rifle platoons where the primary mission became antitank. These were actual practices that developed through free play within the environment of the experiment. The statistical data and recorded observations support the tentative indication that the future requirement for the mortar is questionable.

(c) Of the remaining non-nuclear weapons, a simulated antitank guided missile was used by the experimental force with a certain amount of success against mechanized forces without unduly disclosing the position of the weapon and accounted for 5.2% of aggressor to simulate malfunctions or other aspects of the weapon which might impair its effectiveness. The 90mm tank gun, the 106mm recoilless rifle, and the 3.5 inch rocket launcher continued to function with effect within the ranges appropriate to them. However, unless their use was coupled with a very active displacement or withdrawal tactic, they served to disclose their positions and were destroyed.

(d) The machine gun and rifle, on the other hand, were relegated to a role of insignificance on the mechanized nuclear battlefield. APCs were helpless in the face of powerful direct fire weapons. The riflemen riding in them as passengers rarely got into action. Figure 76 reveals that 49% of experimental force casualties was due to aggressor direct fires against armored vehicles. The foregoing indicates that consideration should be given to

limiting all vehicles on the battlefield to a minimum crew, but providing a powerful direct fire weapon capable of killing any armored vehicle.

(3) Conclusion:

On the tactical nuclear battlefield of the experiment, the direct fire tank-antitank weapons assumed increased importance, and the role of non-nuclear artillery, mortars, machine guns and rifles diminished sharply as evidenced by the following:

CAUSATIVE AGENT	EXPERIMENTAL FORCE CASUALTIES	AGGRESSOR FORCE CASUALTIES
Direct Fire (tank-antitank weapons)	49.0%	33.6%
Artillery	0.8%	1.6%
Mortars	0.1%	0.0%
Small Arms	0.1%	0.0%

(4) Recommendations:

(a) That the antitank capability of the PENTANA-type rifle company be substantially increased, either by providing all fighting vehicles of the company with a direct fire weapon capable of destroying any other armored vehicle, or increasing the numbers and improving the techniques of employment of antitank elements organic to and in support of the rifle company.

(b) That all artillery weapons of the PENTANA-Combat Group be provided a dual capability, i.e., direct and indirect fire.

(c) That mortars be eliminated from the PENTANA-company and that responsibility for provision of indirect non-nuclear fire support by assigned the Combat Group Artillery Battery.

(d) That the number of crewmen in each rifle platoon fighting vehicle of the PENTAMA rifle company be reduced to the minimum consistent with the mission to be accomplished.

61. (C-NOFORN) Tactical Doctrine:

a. Data:

(1) Figure 78 indicates the degree to which the experimental force was able to accomplish missions offensively and defensively. Figure 79 reflects the same data by span of operations.

(2) Figure 80 indicates that as the offensive span of operations increased the ratio of enemy casualties to friendly casualties increased and then dropped. At the 2500-3500 yard span of offensive operations, there were 68 aggressor casualties to 100 experimental force casualties; at 3500-8000 yards the ratio increased to 90 aggressor to 100 experimental forces; and, at 8000-12000 yards, 56 aggressor to 100 experimental force casualties. This casualty phenomenon was attended by decreasing success in mission accomplishment.

Figure 80 also indicates that as the span of operations in which the experimental force defended increased, the ratio of enemy to friendly casualties sharply increased with each increase in span. At the 2500-3500 yard span of defensive operations there were 121 aggressor casualties to 100 experimental force; at 3500-8000 yards the ratio increased to 141 aggressor to 100 experimental forces; and, at 8000-12000 yards, 198 aggressor to 100 experimental force casualties. This favorable casualty phenomenon was attended by increased success in mission accomplishment.

As the experiment developed, tactics rapidly progressed from the use of platoon strongpoints, with conventional OPs for FOs, to dispersed observer teams of two vehicles each, any adjacent two of which could maintain surveillance of the intervals between them, regardless of whether

they were stationary or moving. Distances between observer teams eventually averaged from 500 to 1000 yards. Distances between two vehicles of a team varied from 200 to 300 yards. Platoon leaders and squad leaders, as the experimental runs developed, learned to use terrain in context with mobility, dispersion and the weapons available to them. Costly "reconnaissance by exposure techniques" and excessive casualties from enemy nuclear fires when platoon vehicles are concentrated in a small area, support a requirement for dispersed armored vehicle teams. The observer team must be capable of directing nuclear fires, or non-nuclear indirect fires, and effecting direct fire destruction of enemy vehicles. The two vehicles of the team must be visible, one to the other -- the one to report the disaster in event of the destruction of the other, and both capable of swift, coordinated movement.

The determination of optimum techniques for operations of observer teams employing the dispersed tactic must be the subject of further experimentation; however, the data indicates that while the tactic appears to be a significant step in the right direction, it is more applicable to defensive than offensive action as long as we are restricted to current line of sight surveillance and target acquisition and reconnaissance by exposure techniques.

Until technological advances in combat surveillance and target acquisition permit the attacker to selectively destroy from positions of relative security the dispersed, mobile, nuclear supported forces of the defender, a tactical advantage will continue to accrue to the defender. This consideration emphasizes the importance of utilizing a tactical defensive posture within our strategic offensive efforts. Specifically, strategic mobility and surprise should be employed to seize and control land areas that are essential to, or that threaten the strategic security of an enemy. Once seized, these areas are controlled through fluid defensive tactics to destroy the enemy in his inevitable attempt to regain control of the area.

b. Conclusions:

(1) The experimental force had greatest success defensively and least success offensively as the dispersion increased as indicated by the following statistics:

SPAN OF OPERATIONS	DEFENSE		ATTACK	
	Succeed	Fail	Succeed	Fail
2500-3500 yard span	2	6	7	1
3500-8000 yard span	6	2	4	4
8000-12000 yard span	6	2	2	6

(2) With respect to the experimental force, the ratio aggressor/experimental force casualties was consistently unfavorable in offensive operations in all spans and increasingly favorable in defensive operations as the span of operations increased. This is evidenced by the following statistics:

SPAN OF OPERATIONS	RATIO AGGRESSOR CASUALTIES TO EXPERIMENTAL FORCE CASUALTIES	
	ATTACK	DEFENSE
2500-3500 yard span	.68	1.21
3500-8000 yard span	.90	1.40
8000-12000 yard span	.60	1.98

c. Recommendation:

That company level tactical doctrine, both present and future, be revised:

(1) To emphasize dispersion on the tactical nuclear battlefield between platoons and between elements of the platoon to the maximum of line of sight observation, and

(2) To emphasize, within a framework of the strategic offensive, a concept of habitual adoption of a fluid tactical defensive posture to destroy an advancing enemy force, primarily through the application of nuclear firepower. As a corollary, to relegate to secondary consideration the traditional concept of tactical offensive action (to close with and destroy or capture the enemy by fire, maneuver, and shock action), i.e., a course of action to be adopted only when the situation precludes the exploitation of the fluid defensive posture.

62. (C-MHA) Command and Control:

a. Conclusions and recommendations can be made in the following areas:

(1) Platoon and squad command.

(2) Equipment requirements.

b. Platoon and Squad Command:

(1) Data:

Figure 81 shows, in terms of numbers, the armored vehicles with which the experimental force initiated action in each attack and defense situation over the three spans of operations. The figure also shows the average number of vehicles destroyed in each situation.

(2) Discussion:

The nuclear battlefield is characterized by violence to a degree never previously experienced in warfare. Figure 76 reveals that nuclear weapons and direct fire tank-antitank weapons accounted for 99% of experimental force casualties. Figure 81 reveals that an overall average of 43% of the experimental force's fighting vehicles were destroyed by aggressor nuclear fires and direct fire weapons in each of the relatively short, sudden engagements that occurred. Military observations indicated that a significant portion of this loss could be attributed to lack of skill and imagination on the

part of leaders at platoon and squad level. This indicates that on the tactical nuclear battlefield, where each squad vehicle is virtually isolated and subject to attack from any direction at any time, platoon and squad commanders must possess the greatest procurable skill, professional knowledge, initiative and determination. The problems associated with the procurement, selection and training of these commanders in the required numbers must be a fundamental consideration in the development and implementation of dispersed tactics demanded by the tactical nuclear battlefield.

(3) Conclusion:

To exist on the tactical nuclear battlefield, platoon and squad leaders must possess the maximum degree of skill, professional knowledge, initiative and determination.

c. Equipment Requirements:

(1) Discussion:

In order for the company commander to act with accuracy and speed, he must have available to him the basic facts upon which to base action and application of firepower. The current slow and laborious procedures of map reading, radio communication and acetate posting of the situation are obsolete. This points to the requirement for high speed accumulation and display of intelligence, and an accurate and timely display of the location of friendly elements. Furthermore, evidence from the experiment indicates a requirement for the development of a means by which the leader himself and his superiors automatically and instantaneously are kept informed of his location.

(2) Conclusion:

Development of accurate, instantaneous, position location, transmission and display equipment for all elements on the tactical nuclear battlefield is mandatory.

(3) Recommendation:

It is recommended that priority emphasis be accorded the research and development of accurate, instantaneous, position location, transmission and display equipment for all elements.

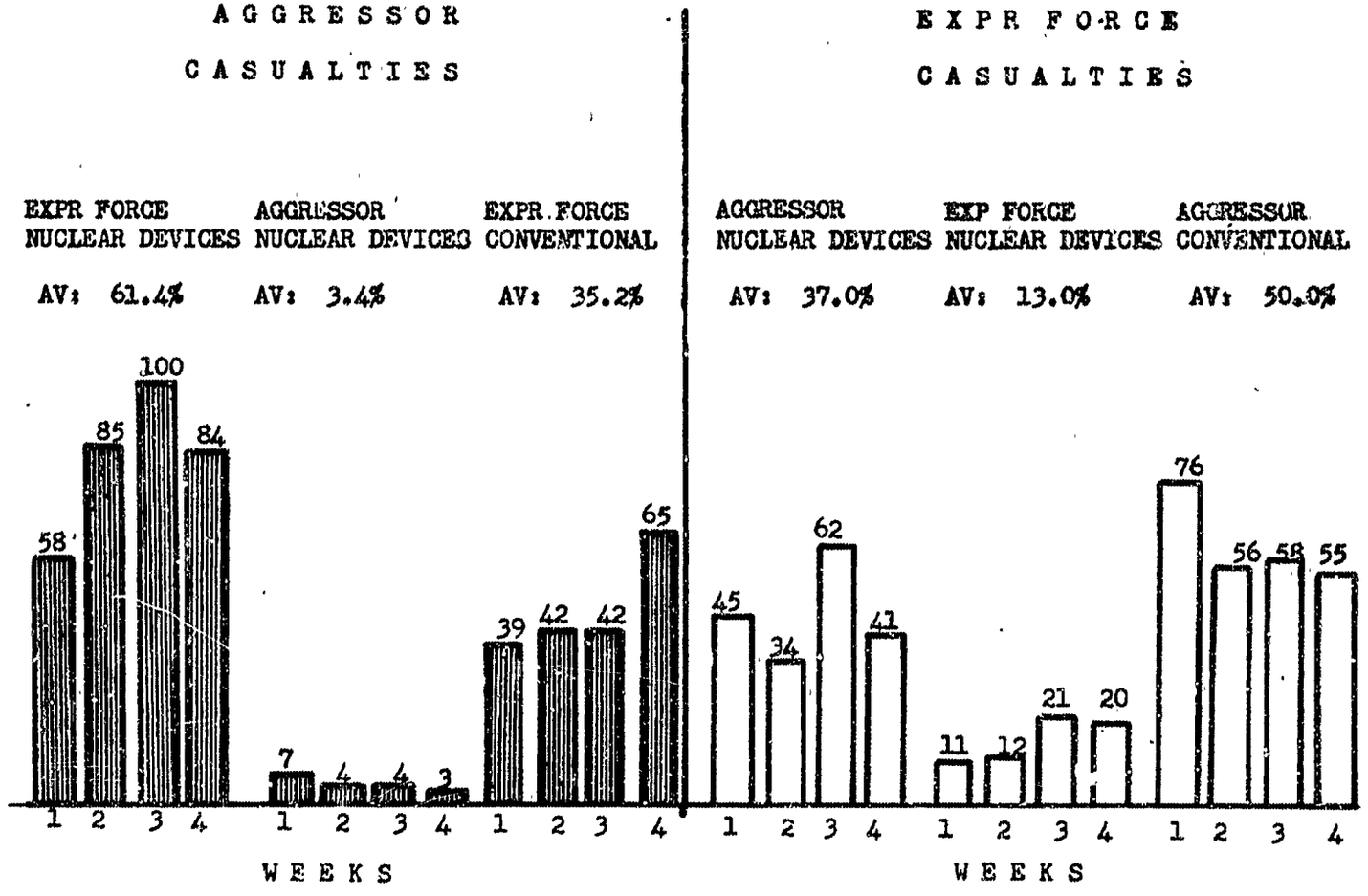
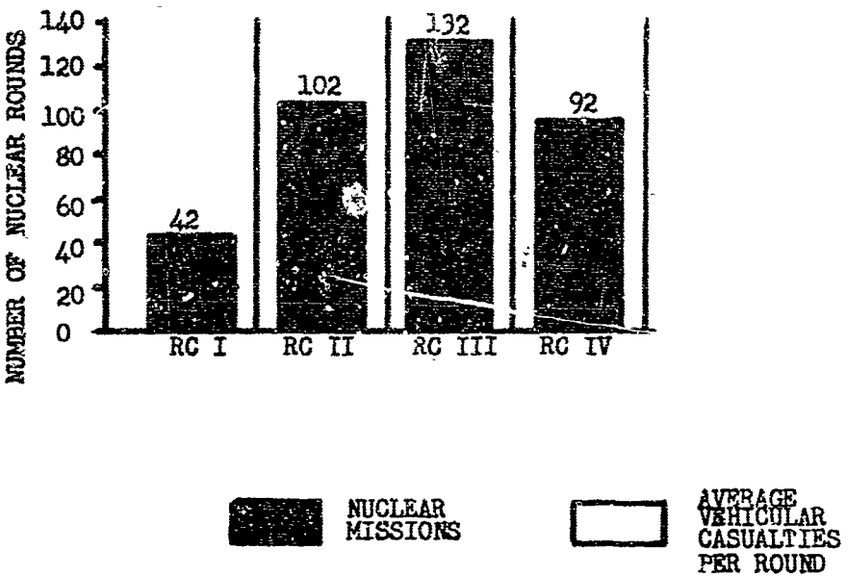

AGGRESSOR
CASUALTIES
EXPR FORCE
CASUALTIES
EXPR FORCE NUCLEAR DEVICES
AV: 61.4%
AGGRESSOR NUCLEAR DEVICES
AV: 3.4%
EXPR FORCE CONVENTIONAL
AV: 35.2%
AGGRESSOR NUCLEAR DEVICES
AV: 37.0%
EXP FORCE NUCLEAR DEVICES
AV: 13.0%
AGGRESSOR CONVENTIONAL
AV: 50.0%
58
85
100
84
7
4
4
3
39
42
42
65
45
34
62
41
11
12
21
20
76
56
58
55
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
WEEKS
WEEKS

FIGURE 74

EXPERIMENTAL FORCE NUCLEAR MISSIONS

INDIRECT FIRE TACTICAL NUCLEAR ROUNDS



VEHICULAR CASUALTIES PER ROUND

AVERAGE 1.8 VEHICLES PER NUCLEAR ROUND

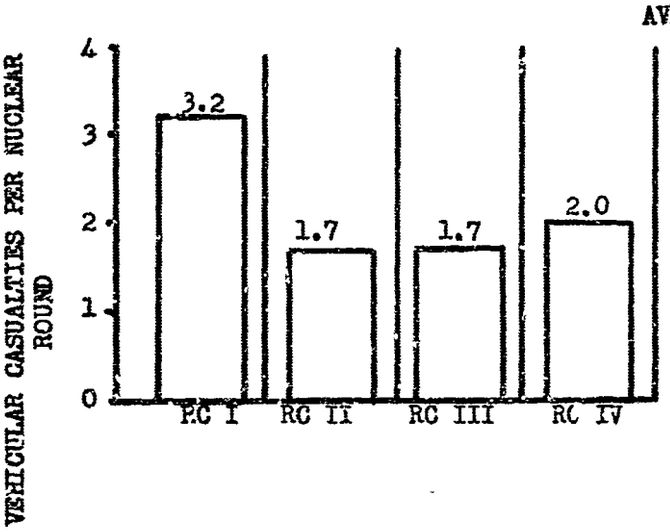


FIGURE 75

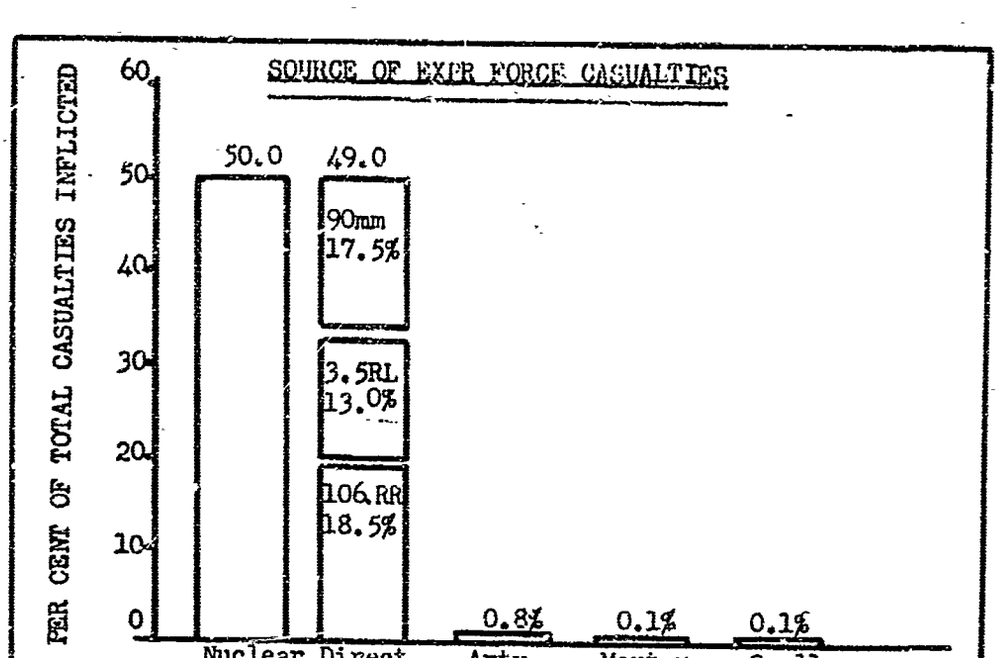


FIGURE 76

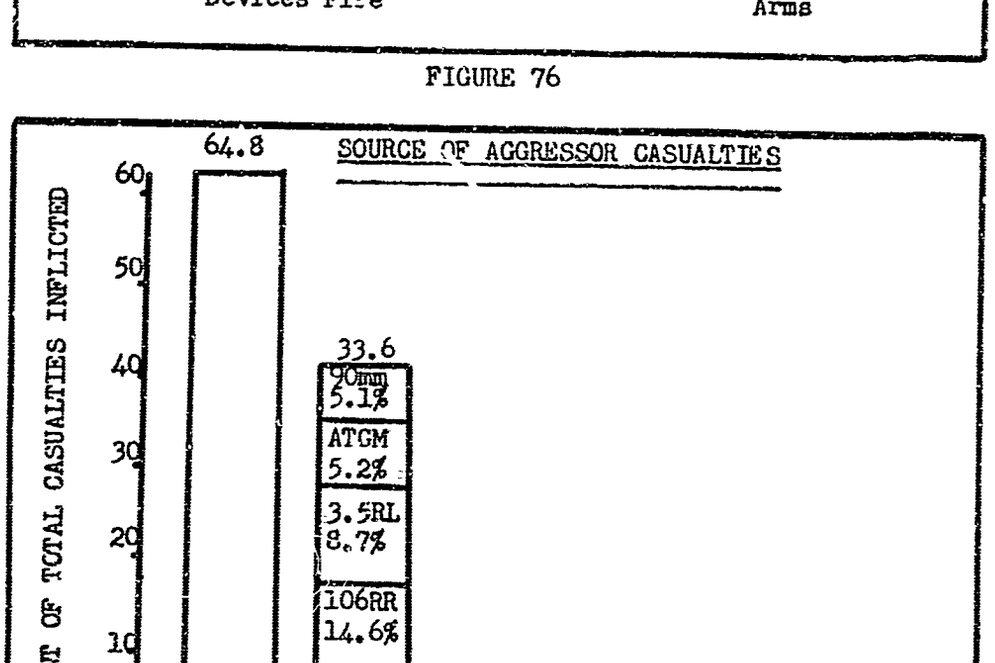


FIGURE 77

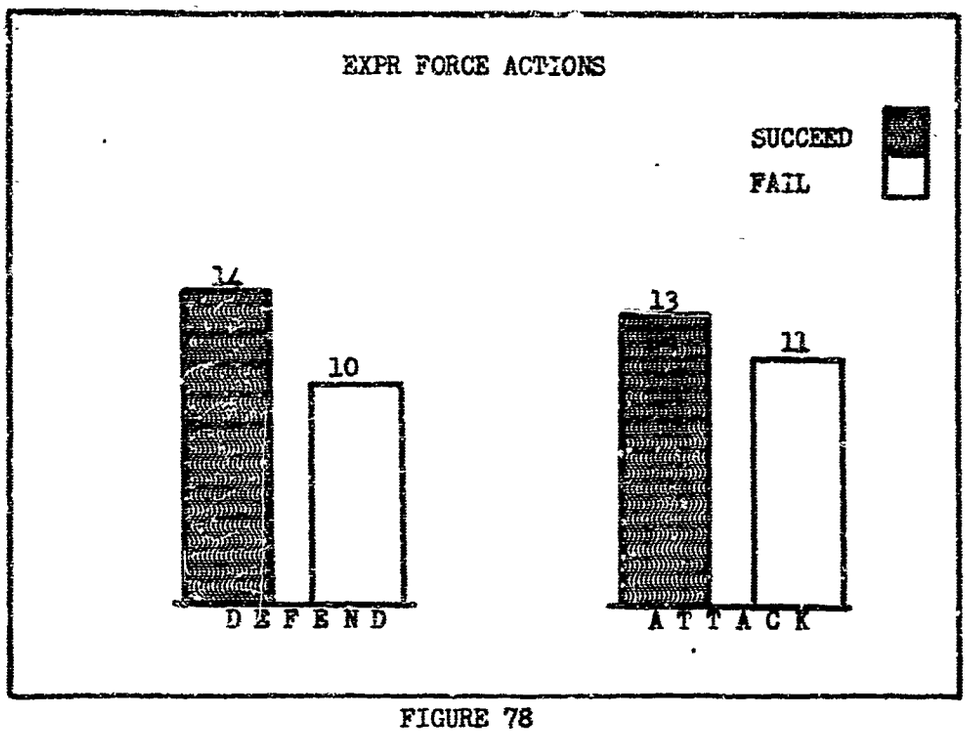


FIGURE 78

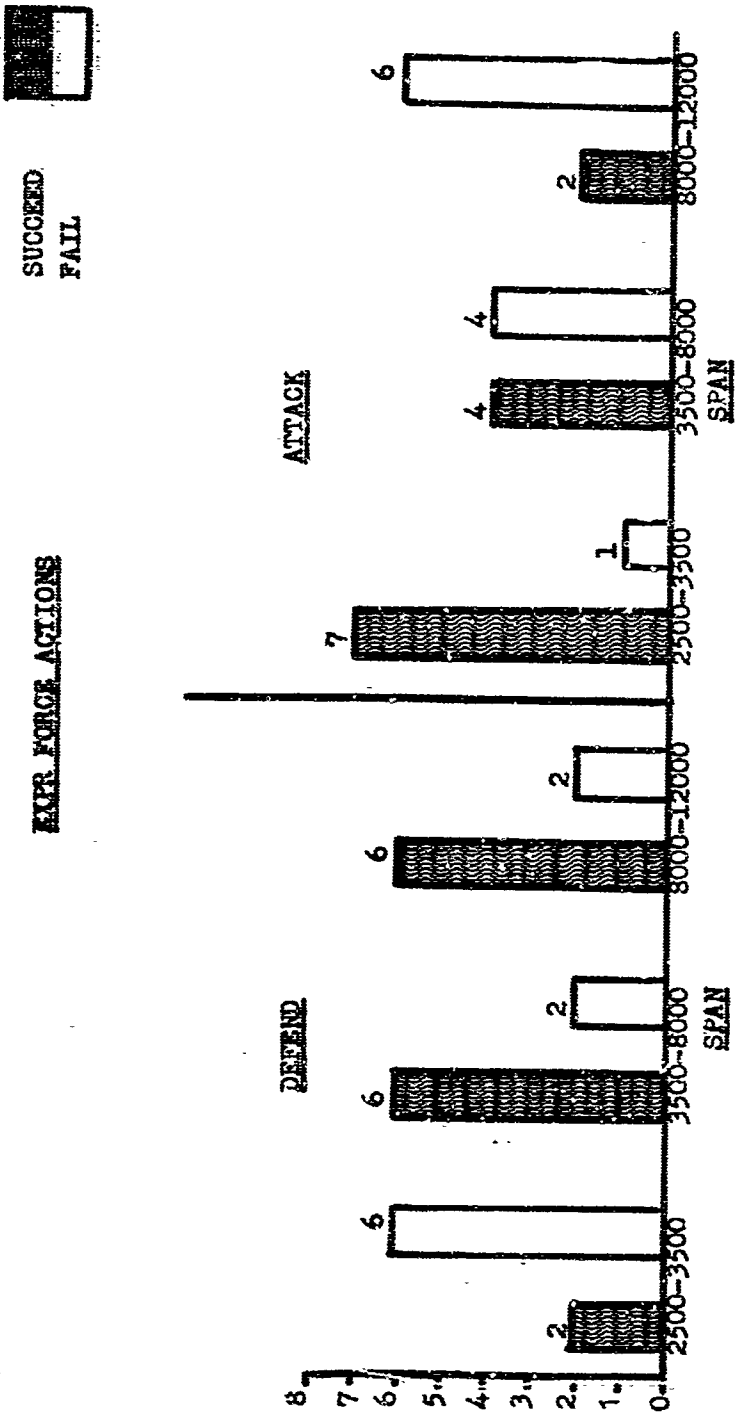

SUCCEED
FAIL
AIR FORCE ACTIONS
ATTACK
DEFEND
SPAN
SPAN
2500–3500
3500–8000
8000–12000
8000–12000
3500–8000
2500–3500
0
1
2
3
4
5
6
7
8

FIGURE 79

RATIO OF AGGRESSOR TO EXPR FORCE CASUALTIES - - - - FOUR WEEKS OF RECORD RUNS

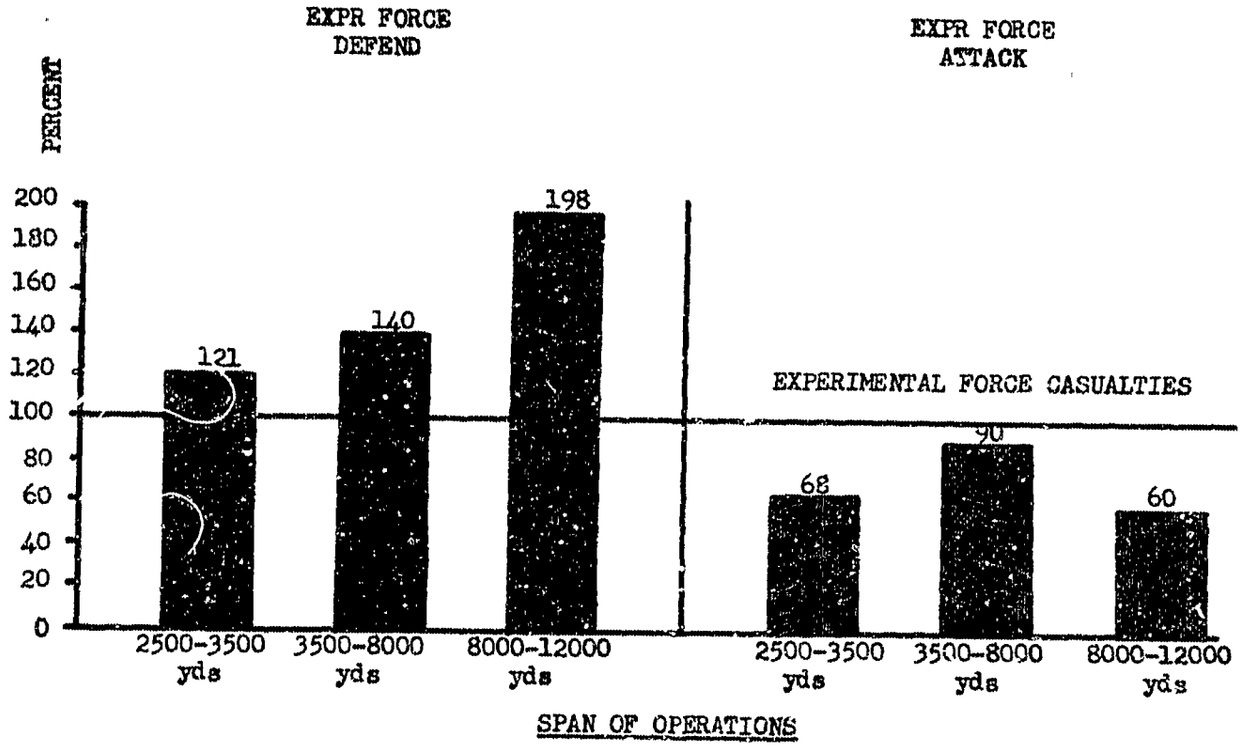


FIGURE 80

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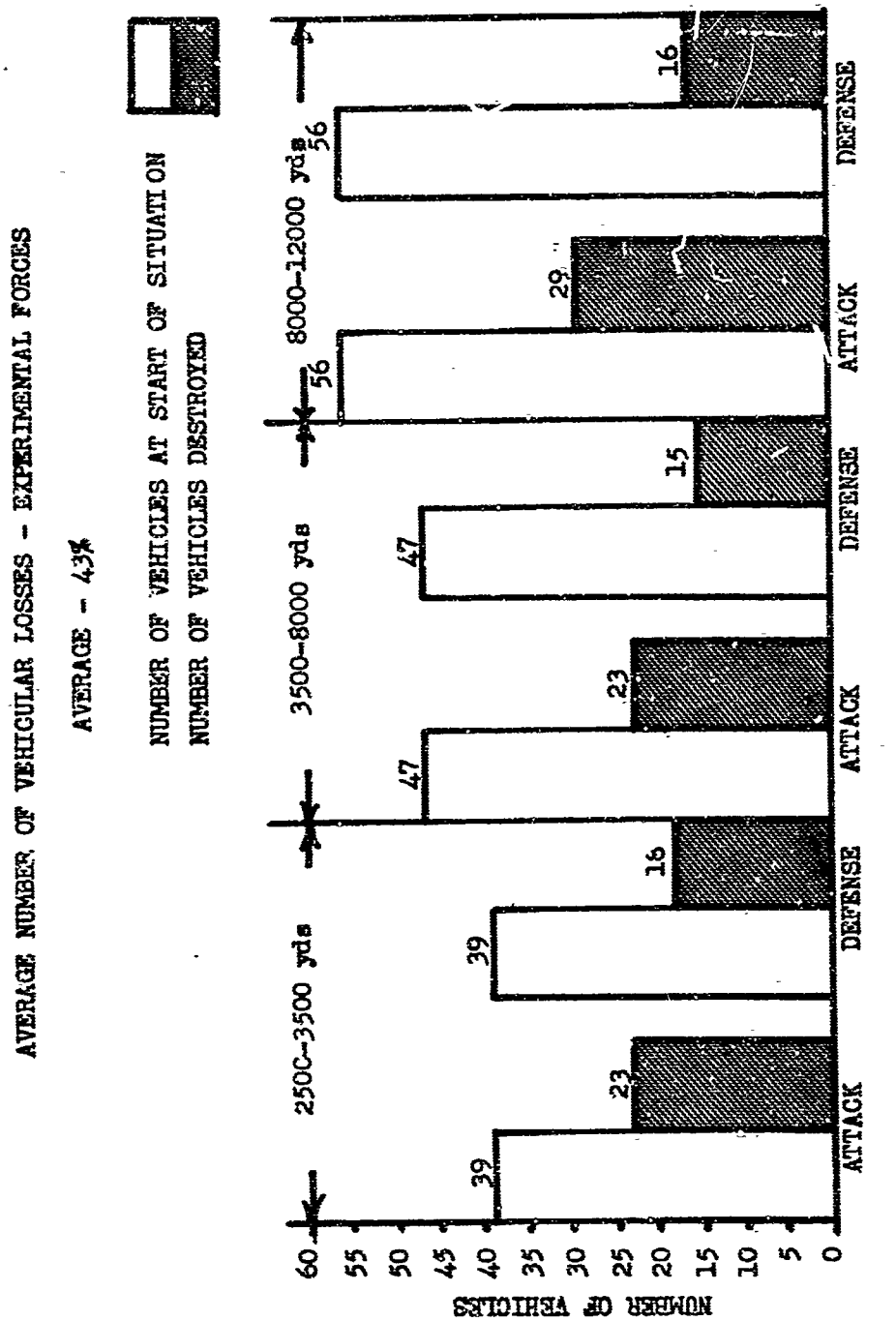
AVERAGE NUMBER OF VEHICULAR LOSSES - EXPERIMENTAL FORCES
AVERAGE - 43%
NUMBER OF VEHICLES AT START OF SITUATION
NUMBER OF VEHICLES DESTROYED
NUMBER OF VEHICLES
60
55
50
45
40
35
30
25
20
15
10
5
0
2500-3500 yds
3500-8000 yds
8000-12000 yds
39
23
39
16
47
23
47
15
56
29
56
16
ATTACK
DEFENSE
ATTACK
DEFENSE
ATTACK
DEFENSE

FIGURE 81

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DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
US Army Combat Developments Command (037210)
Experimentation Command
Fort Ord, California 93941

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b GROUP

3. REPORT TITLE
(6) CONTROLLIABILITY OF PENTANA-TYPE COMPANIES IN MOBILE OPERATIONS
Volume I: BASIC REPORT OF EXPERIMENT.

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
(9) Final Report.

5. AUTHOR(S) (Last name, first name, initial)
USA Combat Developments Command Experimentation Command
Fort Ord, California 93941

6. REPORT DATE
(11) December 1958 (12) 193p.

7a. TOTAL NO. OF PAGES
98

7b. NO. OF REFS

8a. CONTRACT OR GRANT NO.

b. PROJECT NO.

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
CDOG-CDEC 5816

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

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Two PENTANA-type rifle companies were compared, in a tactical field experiment, against a mechanized Aggressor task force supported by indirect nuclear and non-nuclear fires. The purpose was to determine the capability of the PENTANA-type rifle company with various numbers and types of sub units to accomplish assigned missions in day and night operations over extended distances. Basic evaluations presented in this volume of the rep. cover the company headquarters and other elements affecting operational controllability. Other aspects are discussed in successive volumes as follows: Logistics, Vol II; Artillery Support, Vol. III; and Davy Crockett weapons system, Vol. IV.

DD FORM 1 JAN 64 1473

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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Company headquarters						
Command and Control						
Combat mobility						
nuclear warfare						

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